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Switchgear Considerations

Air-break and Air-blast

FOR the first time, so it seems to be believed in the United States, what are somewhat indefinitely described as "air breakers" have been installed instead of the more conventional oil-immersed switchgear for controlling circuits of auxiliary plant in a power house belonging to a prominent Eastern electricity supply undertaking. These switches are of the "de-ion" design, capable of interrupting 23,000 A at 2.5 kV; fifteen of them are accommodated in the lower halves of steel cubicles with silver-contact disconnecting switches directly above, while ancillary gear and meters are attached to the swing doors of the cubicles.

The advantages said to accrue from the choice of air in preference to oil-filled circuit-breakers for this sort of duty are greater safety; avoidance of the need to store, pipe and filter oil; together with some lessening of the expense of inspection and maintenance. These representations are reasonable enough, but any extension of claim in respect of novelty can apply only to American practice. Just twelve months ago we recorded that the first air-break switchgear for power-station service was being provided in more than 100 units by a British manufacturer for the Littlebrook power station of the Kent Power Co. If, however, air-blast circuit-breakers are meant, these have been in satisfactory service for some time in this country at voltages comparable to or higher than those in the United States.

Welsh Installations

For example, for the control of auxiliaries in the Upper Boat station of the South Wales Power Co. there is a row of 3.3-kV air-blast breakers, of the operation of which the station superintendent has spoken highly. They are of the same manufacture as those which make up the five-panel 33-kV truck switchboard in the South Wales Co.'s sub-station serving the Glamorgan colliery of the Powell Duffryn associated group, which has recently converted oil-insulated switchgear at Middle Duffryn to the air-blast arc-control type. Ratings on the generating side are from 2,500 to 4,000 A with a breaking capacity of 400,000 kVA, while on the feeder side the rating is 600 A with a rupturing capacity of 250,000 kVA. New air-blast circuit-breakers of 500,000-kVA size, which are believed to be the first of their particular type to be installed for 33-kV service in this country, have also been erected in each of the four main sub-stations.

When contemplating these developments it is necessary to view in proper perspective the accusation levelled at British manufacturers that they have been slow to appreciate the possibilities of the oil-free circuit-breaker. They are prepared to build and have built them. The I.E.E. paper on March 7th by Messrs. H. E. Cox and L. Drucquer will afford an opportunity of discussing the merits of oil-less metal enclosure of medium-voltage AC switchgear. When reviewing its evolution (ELECTRICAL REVIEW, April 21st, 1939) Mr. H. Rissik pointed out that in few cases can the use of such gear be justified economically and/or technically in this country, where its application is limited to rather special circumstances, usually demanding the greatest rupturing capacities and highest voltages.

Sound Existing Designs

The impetus to change, which has really been a quest for means of lessening the oil-fire risk, did not originate in this country, where proved service records are such as hardly to warrant any radical departure from well-established standard practice. Consequently, development has lately tended towards the minimisation of oil content rather than its complete abolition, together with better understanding of network fault possibilities when selecting switchgear. For example, B.S.S. 116-1937, in its two parts, has given all users a standard by which to judge the performance of high-voltage circuit-breakers. Indeed, realisation of its value has given rise to efforts to impress upon users the need for equally careful selection of low-voltage gear, in respect of which an equivalent B.S.S. is now nearing its final stages of preparation. In his lecture to the Association of Supervising Electrical Engineers last week, Mr. R. T. Lythall ventured to anticipate the new specification by indicating that the short-circuit limits would be the same in both cases; that is to say, 30,000 kVA at 400 V while the limit at higher voltages is defined as approximating to 44,000 A (RMS symmetrical) when breaking, which is equal to 110,000 A (peak) when making.

It is common knowledge that in many cases values much greater than these have been specified by potential purchasers of low-voltage gear. When

analysed there appears to be a good reason for this "misguided comprehension," as Mr. Lythall calls it. It is that values specified in terms of short-circuit kVA are called for and 100,000 kVA does not at first sight appear to be an extraordinarily high requirement nowadays. But if this figure be translated into terms of current, at 400 V it will approximate to 140,000 A when breaking, which is three times the limit now accepted for high-voltage gear. In addition, when the possibility of having to close the breaker on to an existing fault has to be reckoned with, the making current in the above example will rise to anything up to 2.55 times the breaking current, or, say, 357,000 A! This alone is surely a sufficiently good reason why there should be limits in low- as well as in high-voltage applications. Without first laying down reasonable rules of severity, proper selection cannot be attempted with any confidence.

The Domestic Position

THERE are to-day many advocates of closer co-operation with the gas industry, but mindful of the fate of the Latvian lady and her tigrine steed we are a little cautious. Nevertheless we are not averse to learning from our rivals and approving many of their sentiments. For example, we are wholeheartedly with "Janus" of the *Gas Times* when he counsels gas companies to resume the hire-purchase schemes which they hastily abandoned when war broke out. He says that "the gas industry has yet to take fair risks in the commercial market and unless it does, someone will scoop off the cream of the business." No cream-scooping will be accomplished by the electrical industry unless it faces the fact that domestic consumers must be supplied with apparatus on easy terms. We believe, with "Janus," that the great majority of consumers are "static in location and are decent folk who will meet their liabilities" and that it is possible to obtain a fair deal in cases where hirers are called up for service. As in the gas industry, electrical appliance makers have been hit by the over-careful attitude of the supply undertakings and it is not in the national interest that these useful servants of the public should be forced to close down. There is evidence that the Electricity Commissioners are prepared to sanction the financing of reasonable development and business should be carried on as far as circumstances permit. The decision of the Mines Department to suspend the coal, electricity and gas rationing scheme should have a considerable influence on the position. There is no doubt that this scheme, combined with financial restrictions, has done much harm to supply undertakings and its suspension should result in a revision of views upon the subject of domestic electrification which many supply authorities seem to hold.

The Tera

ACCORDING to a system of prefixes recently approved by the French Electro-technical Committee, our public supply generating stations would, under normal conditions, have produced some 30 gigawatt-hours this year. In this system the recognised nomenclature for various multiples and fractions of ten (at present terminated at mega and micro) has been extended to include 10^{12}, 10^{9}, 10^{-9} and 10^{-12}, on the ground that values expressed as powers of ten would be incomprehensible in the shops. Whatever may be the merits of names as against figures, it seems improbable that electrical mechanics, in this country at any rate, would be greatly troubled either way. Usually they think of such terms as megohm and microfarad as absolute and not as relative values. To the average fitter having little Latin and less Greek, the names of the new members of the family, giga-, tera-, nano- and pico-, are more likely to suggest an addition to the number of the Marx Brothers than anything else. On the rare occasions on which he would be required to work to such extreme limits, he would just as easily remember that 10^{9} meant one with nine noughts after it and that 10^{12} had three further noughts as to appreciate that a giant was worth a thousand monsters, as the prefixes would indicate. The etymological derivation of "tera" is itself, we think, symbolic of much scientific nomenclature.

A Manufacturer's Views

THE spirit that animates British electrical manufacturers is admirably demonstrated in a New Year statement made by Mr. G. H. Nelson, chairman and managing director of the English Electric Co., Ltd. In this Mr. Nelson says that their first effort is directed towards the winning of the war by ensuring the supply of essential requirements. Then, as a means of paying for imports, comes the necessity for obtaining orders for British plant in overseas markets. He believes that, provided proper support is received from the Government in the obtaining of the necessary materials, there should be no difficulty in securing considerable business. Active endeavours are being made to obtain orders in markets which Germany has hitherto dominated. Mr. Nelson concludes by urging the importance of looking forward to the period after the war for formulating plans for dealing with the problems which will then arise. The aftermath of the last war should be borne in mind in this connection.

Fires in Bathrooms

BATHROOM fatalities due to the use of portable electric fires seem to be increasing, and it is about time that steps were taken to prevent them. At an inquest into the death of a woman last week three points were brought out. First, that an electric fire had been connected to an immersion heater circuit which was over-fused so far as the fire was concerned; secondly, that twin flex was used; and last, that a fault which developed was invisible from the exterior of the fire. The coroner expressed the opinion that no fire not fitted with three-core flex should be available to the public. With the prevalence of two-pin plugs this is a counsel of perfection, and it is apparently of little avail warning the public against the use of portable appliances in bathrooms. Possibly there are only two remedies. One is the compulsory installation of electric heaters in a position inaccessible from the bath and controlled by cord switches, but we are afraid that there is little hope of this ever being brought about. Supply authorities and contractors should do their best, however, to secure something of the sort in a voluntary way. The alternative is the total exclusion of portable appliances from bathrooms—a rule which it would be impossible to enforce.

Station Costs

COMPREHENSIVE data regarding capital and works costs of fifty-six generating stations are given in the December *Electrical World*. These are classified in eight groups, the first having up to 20,000 kW installed and the last having more than 200,000 kW installed. An analysis of results is made on a common basis of a plant load factor of 50 per cent. and a plant rating of 100/90 of the one-hour station peak. It would appear that in the United States the largest stations, while putting up a better thermal performance than those in the 60,000- to 75,000-kW category, do not make so good a showing in regard to overall works costs, although site considerations may be a determining factor in their favour. Stations having boiler pressures within the range of 1,200 to 1,450 lb. per sq. in. have, thermally, an advantage of only 5 or 6 per cent. over those operated at from 600 to 900 lb., whereas the latter are about 20 per cent. better than the 400-lb. class. Refinements designed to attain the highest thermo-dynamic figures do not generally, it is deduced, make an adequate return on outlay. Nevertheless, experience in Britain is that, other things being equal, it is a sound rule to choose the more advanced conditions if premature stabilisation, and hence stagnation, of technical conditions is to be avoided, bearing in mind future developments.

PRIVATE POWER SUPPLY

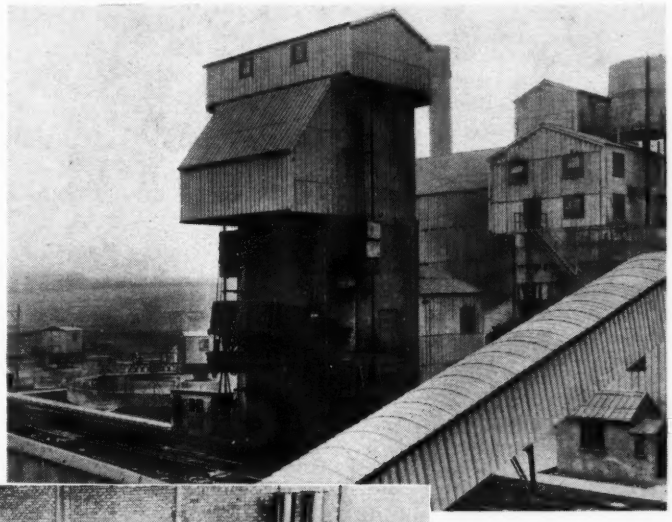
Electrical System at a Modern Cement Works

NOT only electrically is the private electricity generation scheme at the new Southam Cement Works of the Rugby Portland Cement Co., Ltd., of outstanding interest, but it exerts a marked influence on production, and the works installation as a whole represents an excellent example of the fruits of adequate co-operation at all stages of development between electrical and other interests.

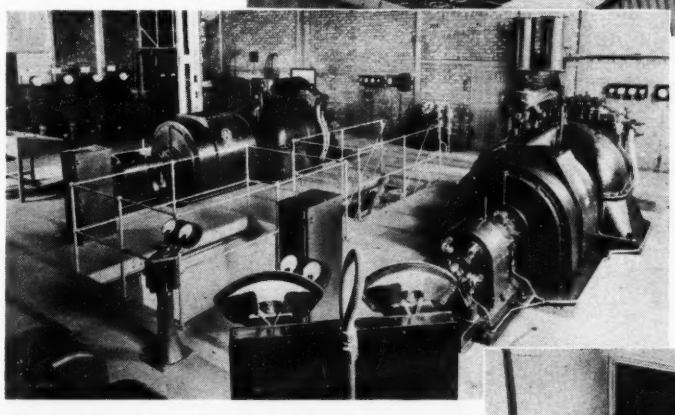
The acquisition of the old works at Southam a few years ago was merely a preliminary to the erection of the new adjoining works to meet the increasing demand for "Crown" cement, and at that time there was a public electricity supply to the works. Negotiations for new terms of supply to meet the needs of the new development were not successful, so Parry & Elmquist, Ltd., consulting engineers to the Rugby Cement Co., recommended a scheme for private generation.

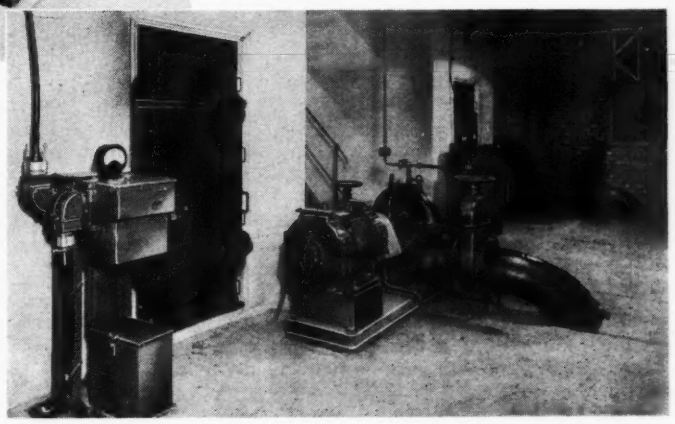
A huge crane gantry, storing the raw and semi-processed materials for cement making, which measures 400 ft. by 90 ft., may be described as the centre of the works from the operation aspect, and to a large extent structurally, and this centre has played an important part in the power-station scheme. The storage of kiln-firing coal in the crane gantry is an essential part of the works system, and so it was decided that the power station should be situated at the end of the gantry where coal is stored in order that the handling plant for the cement-works materials could also be utilised as the main coal-handling plant for the power station, with consequent savings in initial and operation costs.

The concrete coal-bunkers serving the power station are actually situated inside the gantry building, next to the bunkers serving the coal-grinding plant of the cement kilns, and the grabbing crane and conveyor system to be referred to in connection with the works processes should be regarded as the station coal-handling equipment.



Wagon tippler and hoist, showing slurry mixers on the left





The two 1,875-kW sets in the turbine room and (right) the condensing-water circulating pumps

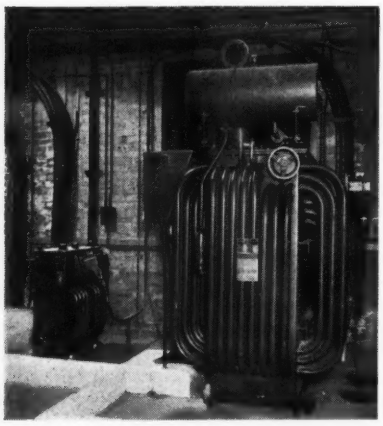
The power station is of steel frame and brick filling construction, consisting of a 70-ft. by 70-ft. boiler house and a 44-ft. by 51-ft. turbine house, with a switchroom annexe running alongside the latter. The reinforced-concrete bunkers serve the stoker hopper of the three boilers by gravity, via traversing chutes. The boilers are of the tri-drum bent-tube type by Clarke, Chapman & Co., each having a normal output of 20,000 lb. per hour, with an overload evaporative capacity of 25 per cent. and a heating surface of 3,648 sq. ft. The steaming conditions are 400 lb. per sq. in. and 750 to 800 deg. F. The chain-grate stokers are by Babcock & Wilcox, and each has a grate area of 126 sq. ft.

Induced-draught firing is employed, and for each boiler an 18-HP motor-driven fan pulls the furnace gases through an economiser or through by-pass flues. Each of the economisers has a heating surface of 1,955 sq. ft. and is of the Green gilled-tube type, the tubes being arranged in horizontal staggered formation.

The flue gases from all three steaming units are exhausted to a 140-ft. reinforced-concrete chimney.

Feedwater is normally pumped to the boilers from a 1,600-cu. ft. hotwell tank by a 55-HP motor-driven Weir pump with a capacity of 5,000 gal. per hour, while a direct-acting vertical steam pump of similar capacity is installed as stand-by. Make-up water to the hotwell is supplied from two Weir vertical evaporators, each capable of producing 35,000 lb. of vapour per 24 hours. Automatic regulation of the feed water to each boiler is provided for by the Cope's system, and the boilers are well appointed with safety valves, high- and low-water alarms, &c. A combined instrument board in front of the boilers is comprehensively equipped to an extent unusual for a power station of this size, but surprise on this account disappears when one thinks

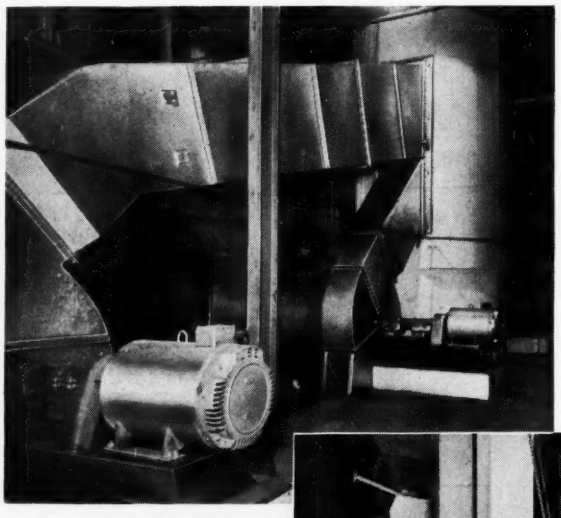
in terms of the overall station thermal efficiency which averages about 16 per cent. CO_2 analysis, recordings of water, steam and gas conditions at all points are provided for and each boiler is equipped with a Lea coal meter. Single nozzle and multi-jet type Diamond soot blowers are fitted on each boiler unit. Ash removal equipment includes a double-compartment type ash hopper, and from an ashpit 10 ft. wide and 10 ft. high running under the length of the boiler house the ash is removed in skips by a Morris two-ton electric hoist.

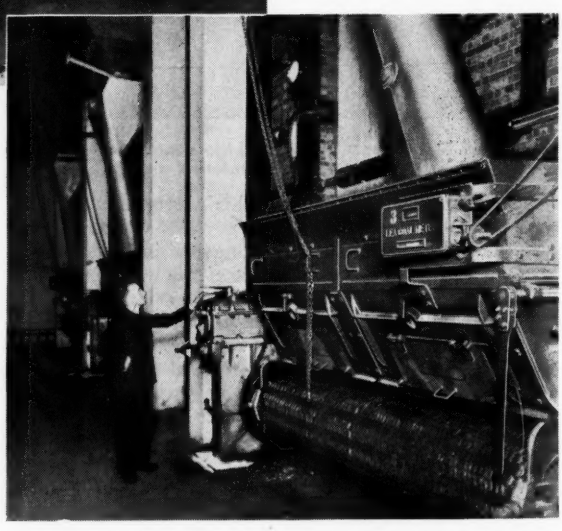


With these main and lighting transformers in the switch annexe basement is shown a typical example of the neat cable work

The generating plant consists of two B.T.H. 1,875-kW turbo-alternator sets, 3,000 RPM. The turbine stop-valve conditions are 360 lb. per sq. in. and 730 deg. F. Each set is complete with a Mirrlees Watson surface condenser of the divided water-head type with a cooling area of 1,943 sq. ft. and designed to circulate 156,000 gal. of water per hour at 80 deg. F. at the inlet, to give 28 in. vacuum at the turbine exhaust flange. With one half of its condenser only in service each turbo set will carry 1,000 kW. Circulating water is dealt with by two 50-HP motor-driven centrifugal pumps which take water from the ponds of two 170,000-gal. per hour Peter Brotherhood natural-draught cooling towers which are designed to reduce the temperature of this quantity of water from 95 deg. F. to 75 deg. F.

The condensate from each turbine is removed by a 4-HP motor-driven extraction pump and is taken to the hotwell via one of the two 30,000-lb.-per-hour 5-in. Lea indicating and recording V-notch measuring equipments. The two V-notch tanks are situated over the hotwell in the boiler house and the recording instruments are separately mounted on tables in the turbine house. A steam ejector air pump of the intermediate jet condenser type is in use with each set.





Above: At the firing floor level and at the back of the boilers are the i.d. fans discharging in the chimney base. Right: The three 20,000-lb-per-hr. boilers at the firing floor

The alternators generate at 3.3 kV, 50 cycles, three-phase, and each is rated at 2,345 kVA at 0.8 power factor. They are protected against internal faults by Merz Price circulating current (with field suppression) equipment, and there is on the main 3.3-kV switchboard a Tirrill voltage regulator which can be used with either set. The main switchboard is an eight-panel equipment by Reyrolle, the circuit-breakers having a rupturing capacity of 75,000 kVA.

Under full production the maximum load on the cement works installation is about 2,500 kW, so that it is necessary to run the two alternators in parallel. The works scheme of operation, however, particularly with regard to clinker production and storage, is such that for half the time it is necessary to run only one set, but with either one or both sets in service the total installation load is such that the actual load on each set is between the most economical limits, namely, 1,250 and 1,750 kW.

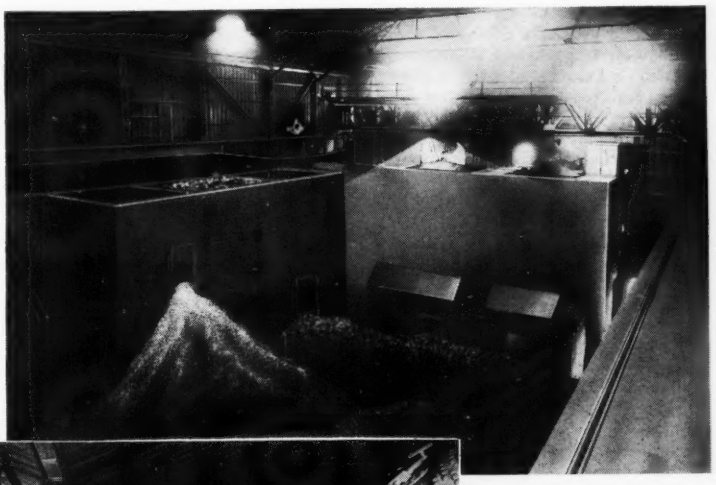
The output of the generating station is about 15 million kWh per annum. Works motors above 125 HP are wound for operation at the generating voltage, but for the remainder of the works supply the voltage is reduced to 440 by two B.T.H. 750-kVA transformers housed in the basement of the switchhouse annexe. These are equipped for off-load tapping and they supply to a Reyrolle eleven-panel switchboard with nine works feeder units. Both the e.h.v. and the l.v. switchboards are on the operating floor of the turbine room.

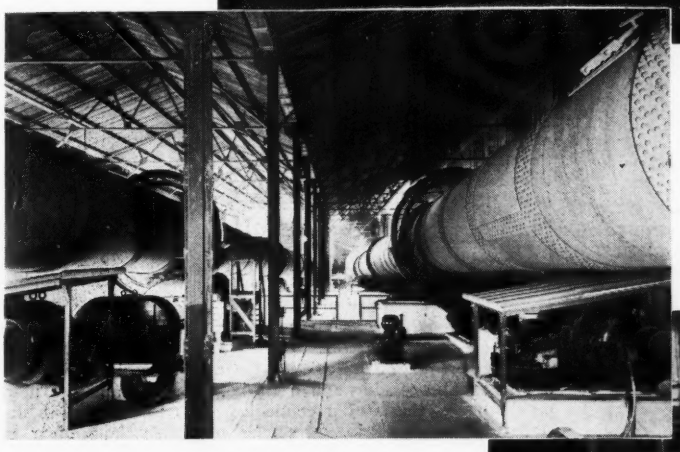
Throughout the works there are about 120 B.T.H. motors from 785 HP each downwards, representing a total installed load of about 5,000 HP. Most of the motors are for constant-speed work and of the slip-ring or squirrel-cage types, but there are five large motors specially installed for power-factor correction. Two 785-HP and one 450-HP synchronous induction motors operate at 0.9 leading power factor, and two 125-HP "No Lag" compensated motors operate with a leading power factor of 0.8. The overall result is a power factor at the station bus-bars of 95 per cent. lag to unity. To meet variable-speed requirements there are some slip-ring motors with rotor resistance speed control and AC commutator motors for the kiln drives. But for the smaller variable-speed drives DC motors are used supplied from two 15-kW m.g. sets.

Local power distribution throughout the works is by either Reyrolle 3.3-kV non-automatic oil circuit-breaker isolating boards or English Electric 440-V boards with high-rupturing-capacity cartridge fuses. The majority of the motors are controlled by B.T.H. oil-immersed starters equipped with ammeters calibrated in both amperes and horse-power. Generally these starters have time-lag overload coils and no-volt releases. For use where greater flexibility of central control is required, such as in the case of kiln house auxiliaries, cement transport and cement packing plant motors, there are a number of Brookhirst contactor panels.

Lighting throughout the works is at 110 V AC and is supplied from five 440/190/110-V 30- or 20-kVA transformers at various centres. At each of these centres

there is a Simplex main control panel with individual d.p. switch-fuse units. Simplex and Benjamin lighting equipment is employed and consists generally of dispersive reflector units, "Glassteel" diffusers and well-glass lanterns. All power distribution up to the works boards and wiring for the larger motors is carried out by p.i., l.c. s.w.a. cables, while for the smaller motor wiring and for the lighting generally v.i.r. cables are used in screwed conduit. A notable exception to this scheme is the boiler-house lighting installation, which is carried out in "Pyrotenax" fire-proof metal-clad cable to stand up to the hot boiler-house atmosphere. All the normal cables employed in the works are of Johnson and Phillips manufacture.





Above: Cement kilns and their 90-HP AC commutator drives. Right: The limestone crushing plant is driven by two 150-HP motors

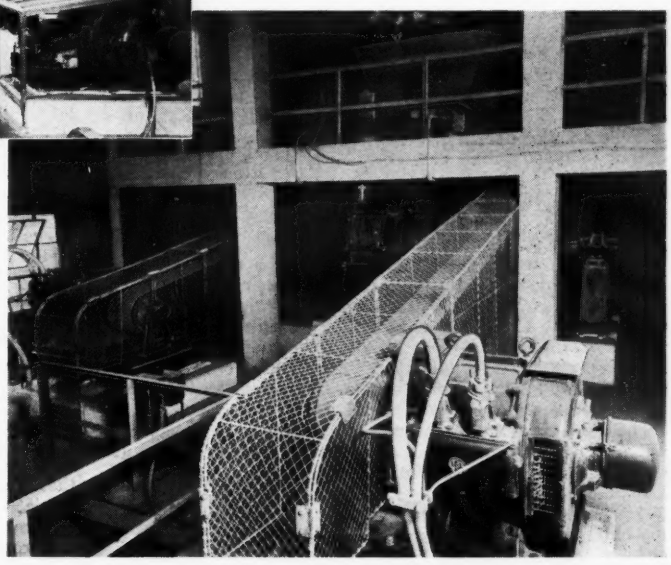
Except that it is larger and that there are modifications necessary because of slightly different raw materials, this works and its processes are similar to those at the new Rochester works which we recently described, so that we do not propose to enter into details to the extent that we did in connection with the other works. We have already said that the works is built around a huge crane gantry. This building has a storage capacity of 25,000 tons and is served by an overhead all-electric 10-ton Arrol grabbing crane with a 150-HP hoisting, a 50-HP travelling and a 15-HP traversing motors.

The works main raw materials consist of the famous Warwickshire blue lias limestone and shale from the quarry situated near the works. Coal and gypsum in addition to a certain amount of chalk arrive in main-line rail trucks, which are elevated and emptied by a Mitchell tippler hoist incorporating a weighbridge. The materials are discharged into a hopper, under which is a pan feeder so arranged that when chalk is being handled it is passed into a crusher which, in turn, discharges into a belt conveyor.

This conveyor discharges chalk into the washmill or into a bin in the crane gantry, gypsum into a similar bin and coal into the coal storage space.

Water is added to the chalk in the washmill and the product is a slurry which is elevated and passed through three slurry separators, from which the fines are discharged into one of six slurry tanks and the coarse material is either returned to the washmill or fed to the raw mill along with the crushed limestone, shale and water. Limestone and shale are brought from the quarry to the receiving hopper of a crushing plant, which reduces it to 1½ in. by a double swing-hammer mill. This mill is belt-driven by two 150-HP motors which are separately controlled. The crushed stone is then delivered direct by a belt conveyor to the gantry building or to the hopper of the raw mill, driven by a 450-HP synchronous induction motor and producing a slurry which is elevated and discharged into one of the six correction tanks. Slurry in the correction tanks is agitated by air supplied from a compressor driven by a 50-HP motor and then run in correct proportion into the "sun and planet" storage basins, from which it is pumped to any of the new and old kilns. There are two new kilns, each 300 ft. long and 9 ft. in diameter and driven by a 90-HP, 760/190-RPM AC commutator motor which also drives an alternator serving the kiln feeder motor.

The handling plant for the cement works materials is also the coal-handling plant for the power station



The kiln firing plant includes two air-swept mills, each driven by a 125-HP "No-Lag" motor and a raw-coal dryer. Via the crane gantry the clinker is taken to two cement mills, each driven by a 785-HP synchronous induction motor, and from these mills the works product, now cement, is blown across to the silos by an electro-pneumatic transporting system served by two 110-HP motor-driven air compressors.

There are four new reinforced-concrete 1,600-ton cement silos, and two rotary packing plants, one of which can deal with 2,000 bags per hour.

Messrs. Parry & Elmquist, Ltd., were responsible for the design, erection and supervision of the complete works, including the power station, and their chief electrical engineer, Mr. E. Scherman, A.M.I.E.E., was in charge of the whole electrical and power installation.

SWITCHGEAR LAYOUT

Problems for the Works Electrical Engineer

By R. T. Lythall, A.M.I.E.E.

IN an earlier article* the attention of works electrical engineers was drawn to a number of problems associated with the application of low-voltage switchgear, and it was indicated that they could give valuable help by adopting layouts designed to eliminate certain features which produce the problems.

In considering this, appreciation of manufacturing difficulties is necessary, the major one being that of breaking capacity. This has been discussed at some length in articles published in the REVIEW and it is only necessary to recall that 30 MVA at 400 V represents a breaking capacity equal to 500 MVA at 6,600 V, namely, a short-circuit current (breaking) of 43,800 A in each case.

The national emergency has caused a very considerable increase in industrial load and factory owners are faced with the need to provide new or to extend existing switchgear and plant. These represent two distinct sets of the works engineer's problems.

As regards the switchgear normally installed at the main point of low-voltage supply, we are to avoid, if at all possible: (a) High values of short-circuit current beyond the capability of clearance by standard circuit-breakers; (b) high values of normal current in any one circuit; (c) inability to give regular maintenance to any switchgear equipment.

New Installations

Tackled right at the beginning, a new installation should present little difficulty. The adoption of certain features in the electrical layout will, in spite of higher first cost, be true economy in the long run. I am, however, well aware of the economy that is forced on the works engineer, often made worse by the allotment to him of inadequate and unsuitable premises. Efficient service can amply repay the user for his high first cost. The advantage becomes even more apparent when extensions have to be made, as the scheme of things can be then such as will fit exactly and the installation does not get out of hand.

The first rule to be adopted is to set a limit to the plant (usually transformer) capacity to be connected to any one section of bus-bar. This limit cannot be laid down specifically as external circumstances may require variations (*e.g.*, external reactance due to connections), but the works engineer is wise to adopt a limit of 1,500 to 2,000 kVA at 400 V three-phase. This is a total value per bus-bar section, which may comprise one unit or alternatively a number of smaller units in parallel.

If the total load is within the named limit, then problem (a) is solved, but if greater plant capacity is necessary, the bus-bars should be sectionalised so that the installation will comprise two (or more) sections to each of which plant of a capacity up to that stated is connected. In normal operation section switches would be left open. A word of warning here is necessary. Make certain that, in the layout of the distribution network *beyond* the main switchgear no feeders connected to different sections are paralleled.

The number of sections in a large scheme may be four or five and this at first sight may be thought extravagant. I have been associated recently with the layout of a scheme involving nearly 10,000 kVA of transformer capacity at 400 V. Here the limit of 2,000 kVA per section was adopted right at the beginning and extensions continue on this basis without difficulty or fear of exceeding breaking capacity limits, yet without any sacrifice of flexibility.

Maintenance

Now as to problem (b). Superficially, this might appear unimportant, but consideration will indicate that not only does a small unit present fewer difficulties due to heavy-current switchgear, but also that, for example, three 500-kVA units allow two to remain in service while—most important—the switchgear for the third receives maintenance. The installation of one 1,500-kVA unit appeals on the score of economy, but it means that the equipment probably gets no maintenance, which adds to the possibility of breakdown, and then the supply is lost completely, instead of in part. It should be remembered that heavy currents lead to overheating, that they entail greater maintenance and that the heavier the gear the more skilled must be the worker delegated to its maintenance.

So far then, a recommendation is made first to sectionalise and secondly to divide the plant capacity into a number of units. Having adopted these two rules, problem (c) is automatically taken care of. Obviously, sectionalising demands more than one unit so that solving problem (b) allows the rule for problem (a) to be applied.

At this point it may be asked whether low-voltage distribution is warranted when large blocks of power are involved. The answer is for the user to supply, but it is clear that often the systems would be better laid out, the fear of complete interruption would be reduced, and many problems associated with low-voltage switchgear would be removed if high-voltage distribution were adopted. This involves a number of sub-stations at various points in the works, with transformers at those points of sufficient capacity only for the needs of adjacent departments. This is costly, but it avoids the laying of heavy-current low-voltage cables and improves voltage regulation.

Existing Installations

The extension of an existing installation in which plans on the lines of the foregoing have not been made presents greater difficulty to the works engineer and manufacturer alike. A business started in a small way may expand beyond the dreams of those responsible for the initial scheme. It may also be that in those early days the then engineer thought fit to ignore fault values or the manufacturer placed no limit to the breaking-capacity he was prepared to assign to his switchgear. Extensions bring the engineer face to face with any or all of the problems enumerated.

The obvious solution to problem (a) is naturally sectionalising, but if space or other considerations do not allow of this, what then? In such circumstances, consideration should be given to the possibility of building a new sub-station for the extension, regarding the initial sub-station as one section of the whole.

To convert one of the existing feeders to a section switch is not usually impossible and a tie between this and the new gear provides the bus-bar connection. By this means an installation based on the principles previously laid down is started. Space for the additional sub-station is, of course, necessary and may be difficult to secure, but its area should allow for the continuance of sectionalising if further extension becomes necessary.

The sacrifice of some adjacent building must be considered in the knowledge that if the productive capacity of the works is dependent on electrical energy, the sacrifice is offset by the efficiency and reliability of the electrical equipment.

A possible solution is the addition of reactance to the system, probably in the transformer circuits or in the bus-bars. This, however, is not an easy way, as at lower voltages heavy-current reactors are costly, take up considerable space, and add to voltage regulation difficulties.

Regrouping Possible

Our problem (a) often appears in a much more vicious form, that of an existing installation of some magnitude where only a relatively small extension (or maybe no extension at all) is contemplated and by experience the engineer appreciates that his present gear is not all that it was at one time considered to be.

It may well be (and this has been actually experienced in a number of cases) that so much plant is connected to a single bus-bar section that the fault current is not only beyond the capability of the old breakers, but also outside the limit now set by manufacturers for modern breakers. Thus replacement does not completely solve the engineer's problem.

We are forced, in such circumstances, back to the one real solution—sectionalising—and it is here that the major difficulties arise. In most cases the original installation permits the paralleling of two or more feeders at a remote point. Sectionalising of the main switchgear alone would not, therefore, meet the case. A regrouping of feeders must be contemplated, therefore, even at the expense of relaying cables, the regrouping being such that paralleled groups relate only to one section of the main board.

A solution might be found without regrouping by suitably

(*Concluded at foot of next page.*)

* "Low-voltage Breaking Capacity." By R. T. Lythall, ELECTRICAL REVIEW, April 30th, 1937.

AGRICULTURE IN WARTIME

By F. E. Rowland, A.M.I.E.E.

(*Manager, Agricultural Department, General Electric Co., Ltd.*)

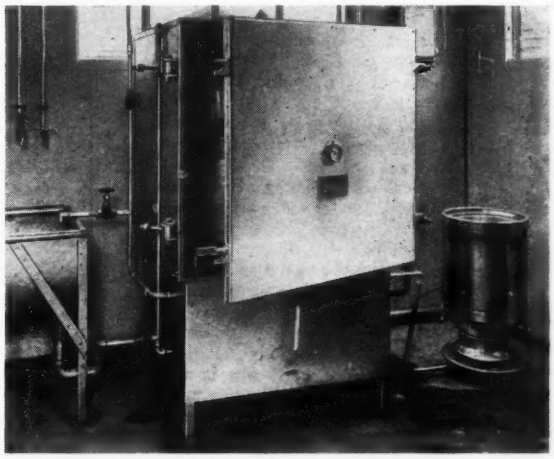
PRIOR to the outbreak of war there was considerable speculation as to its effect on agricultural electrification. In some quarters it was thought that development would be drastically curtailed, while the demand for new equipment would also greatly decline. Other opinions were that the effect would not be great and, in fact, demand might be stimulated by the expansion which was bound to occur in the agricultural industry. Now that the initial stage of unsettlement is past the present position and future prospects may be considered in the light of existing circumstances.

There are many reasons why the present situation may lead to considerable expansion in the use of electricity in agriculture. By its employment imported fuel supplies are conserved and as electricity is supplied direct to the premises where it is used fuel and labour for transport are saved. It is essential for farmers to make the most effective use of the labour available, and as there is likely to be a shortage of skilled workers and labour for heavy work, the wider use of electricity may be anticipated. Much heavy work previously performed by men will have to be done by land girls, and the employment of electric motors will greatly facilitate the performance of duties previously done by hand. The ease of operating electric motors makes them particularly suitable for such duties. Engines may frequently be troublesome to start, especially on cold mornings and may require skilled attention to keep them in running order.

Electricity in the Dairy

For heating, particularly in dairies, electricity eliminates heavy labour for stoking fires as well as the necessary skill and experience to obtain satisfactory results. For instance, for sterilising milking utensils for the production of accredited milk with electricity, no previous knowledge or skill is required, the whole process being accomplished by operating a switch and reading a thermometer. In fact, the most inexperienced worker can obtain positive results right from the beginning.

Some apprehension has been caused by unfounded rumours that the accredited milk scheme might be dropped in wartime and that consequently the demand for dairy sterilising equipment would cease. These rumours are without foundation and no such action is contemplated at present, while it is unlikely that the scheme would be dropped except in an extreme emergency. A very large proportion of milk is now produced under the scheme and the maintenance of hygienic production is possibly even more important in war than peace. In peacetime a large proportion of the milk supply is sent to central dairies in large cities where it is processed before distribution, while at present, due to evacuation, a large quantity is supplied direct for consumption by children without such precautions being possible.



Dairy sterilising chest which also supplies hot water and steam for churn stool

Another result of decentralisation of milk consumption may be a greater call for small pasteurising plant. Owing to the increased demand for milk for direct consumption in rural areas, dairymen and producer-retailers are faced with the necessity of pasteurising their own milk. This is not only to ensure its wholesomeness, but also to improve its keeping qualities, there being only one delivery per day. For such small pasteurising equipment electric heating is particularly suitable, because it does not require labour and may frequently be installed in existing premises without structural alterations. The reduction in the number of deliveries will undoubtedly lead to an increase in the demand for milk-cooling equipment during the spring and summer months.

Ultra-violet Irradiation

If the war should last for an appreciable time, it is possible that a demand will arise for new applications of electricity. An example of such a demand has already occurred. For certain forms of intensive poultry husbandry a supply of cod liver oil is essential as a source of Vitamin D, which must be supplied artificially due to the birds being kept indoors permanently and deprived of sunlight. There was considerable alarm among poultry keepers soon after the outbreak of war on account of the possible cessation of supplies of oil. It has been announced since that arrangements have been made for sufficient supplies, but the situation might change in the future and an alternative source might become essential. Ultra-violet irradiation may be employed for this purpose and while this has been well known in the past it has not been developed commercially because cod liver oil produced equivalent results at much lower cost. The possibility of a situation arising where alternative means are required, however, has led to experiments being initiated to establish practical methods of application.

In view of rationing, some farmers are apprehensive of increasing their electricity consumption. This should always be borne in mind by those interested in the supply of electricity and electrical equipment, otherwise it might lead farmers to adopt alternative methods. They should be advised, if they are apprehensive, to apply to their local fuel overseer stating that the increased demand is required for agriculture and food production, when there is little doubt that their full requirements will be met.

It is hoped that the situation arising from the war will not lead to difficulties in furnishing or extending electricity supply in rural areas, because otherwise many good opportunities for development may be missed.

Switchgear Layout (*Concluded from preceding page*)

interlocking the section switch at the main board with the links which parallel the feeders at the remote end. Trapped keys would ensure that unless the section switch is closed, the remote links cannot be closed. This scheme rarely commends itself due to the complications involved, but it may be worthy of consideration in a small way.

Problem (b) does not arise so frequently in the case of extensions. Usually it is the "growing-up" of the scheme which causes difficulty, but in "growing-up" small units are added to small units. If a large extension is contemplated, then the arguments previously put forward still apply.

Problem (c) similarly can only arise by adding one large unit rather than two or more smaller ones. The importance of maintenance applies equally to old and new gear and the engineer has achieved a great deal if he obtains a scheme permitting maintenance of every circuit.

Most manufacturers are anxious to-day to help the works engineer to install gear designed to give real service. They can, however, do little if the scheme is planned haphazardly and without regard to the voluntary (and practical) limits which the manufacturer has now recognised in low-voltage switchgear.

Works engineers may find considerable help beyond the present article by re-reading the following articles published in the ELECTRICAL REVIEW, each dealing with aspects of the problems just discussed:—

"Calculating Fault Currents." By C. J. O. Garrard. September 24th, 1937.

"Low-voltage Breaking Capacity." By R. T. Lythall. April 30th, 1937.

"Low-voltage Switchgear." By R. T. Lythall. January 14th, 1938.

"Low-voltage Short-circuit Values." By R. T. Lythall. January 27th, 1939.

"Short-circuit Power Factor." By C. J. O. Garrard. May 26th, 1939.

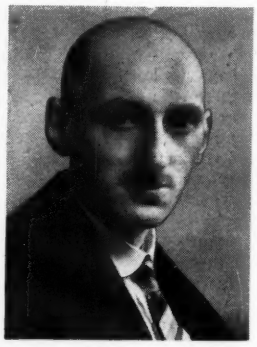
"Low-voltage Short-circuit Calculations." By R. T. Lythall. November 18th, 1938.

STEAM CONDENSERS

Relative Merits of Different Alloys

By V. Walker, A.M.I.E.E.

THERE has recently been a tendency to replace condenser tubes made of the older alloys, such as Admiralty metal (Cu. 70, 2 w 29 and Sn 1 per cent.), by those of more resistant alloys. The forms of corrosion most prevalent in condenser tubes are destructive cavitation or inlet-end corrosion and general dezincification. Individual operating conditions, however, affect the service life of the tubes, so that comparisons as to the relative merit of any alloy must take into account all the operating factors. These include the nature of the circulating water, seasonal variations in character and temperature of the water, volume of water boxes in relation to capacity of circulating pump, location of circulating pump (high or low level) and method of installing tubes.

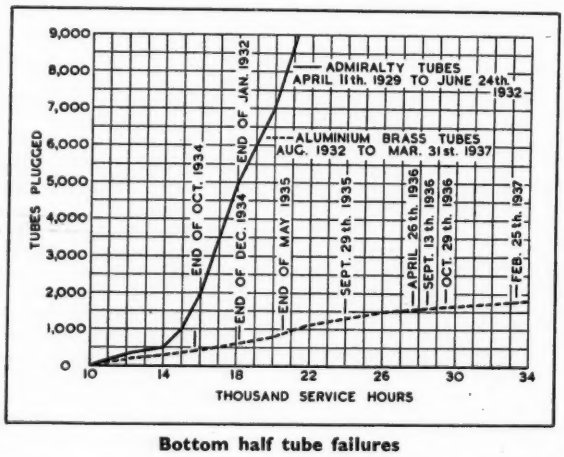


Mr. Walker (Bury Corporation Electricity Department)

For resisting cavitation it has been found that aluminium-base and cupro-nickel alloys are superior to Admiralty brass. Both these alloys give longer and more economical service than Admiralty brass under conditions where failure has occurred due to inlet-end corrosion or destructive cavitation.

Copper-nickel alloys in common use contain 20 to 30 per cent. nickel with the balance of copper. Sometimes 5 per cent. zinc is added to the 20 per cent. alloy, but this has no important effect on corrosion. This alloy has been used when all-round corrosion resistance is desired and gives excellent results with contaminated water supplies and with salt and brackish waters. It also has high physical properties both at normal and elevated temperatures. Because of these chemical and physical properties the alloy is finding increasing use for marine condensers and for salt and tidal water installations, particularly where the life of ordinary alloys is relatively short due to end corrosion (air-impingement attack), plug or layer dezincification or severe general corrosion. It is also used in heat exchangers and superheaters.

Aluminium brass has the normal composition of copper 76 per cent., aluminium 2 per cent., zinc 22 per cent. It has shown superior service when circulating water velocities are high or where turbulence of the water results in end corrosion. It has the property of forming on its surface a thin, tenacious, self-healing film which makes the tube highly resistant to erosion as well as corrosion. Aluminium brass is not resistant to dezincification, but a modification of the alloy which is thus resistant contains copper 82 per cent., aluminium 2 per cent., tin 1 per cent., zinc 15 per cent.



Bottom half tube failures

Tube Failures

The accompanying figure, taken from the Prime Movers' Committee's report for 1937, shows "tubes plugged" plotted against "service hours" for a large condenser at the Hell Gate station of the Consolidated Edison Co. of New York. The failures per 1,000 tubes per 1,000 service hours were reduced, due to the adoption of aluminium-brass tubes in place of Admiralty tubes, from 4 to 0.4 in the top half of the condenser and from 26.9 to 4.0 in the lower half. For resisting dezincification red brass containing 85 per cent. copper and 15 per cent. zinc and arsenical copper with a nominal arsenic content of 25 per cent. are commonly used. Since arsenical copper is essentially a one metal containing no zinc it cannot dezincify as other copper-zinc alloys frequently do under certain conditions.

Velocities are also of great importance. In one case two power stations employed circulating water of similar chemical analysis. In the first the average water velocities were 3.5 to 4.3 ft. per sec. in the first pass of the condenser and 5.2 to 5.6 ft. per sec. in the second pass. In the second power station the velocities were 7.6 ft. per sec. in the first pass and 9.3 ft. per sec. in the second pass. Admiralty metal tubes in the first station failed through dezincification, resulting in layers of redeposited copper and in pits filled with copper crystals. The service life averaged from 35,000 to 42,000 hours. Admiralty tubes in the second station failed after 16,000 to 17,000 hours' service from impingement affecting the entire length of the tubes, and resulting in pitted surfaces which were metallically clean at the points of corrosion and apparently protected by a thin scale at the uncorroded spots.

The type of corrosion experienced with Admiralty metal tubes appears indicative of what may be also expected with special alloys. Three groups of such alloys have been tried, including copper, copper-nickel and copper-aluminium alloys. Pure copper and arsenical copper gave similar service to that of Admiralty tubes, failing after 16,000 hours in the case of the second station. Tubes with 20 per cent. nickel and 5 per cent. zinc gave slightly superior service in the second station but not in the first. Aluminium brass tubes gave superior service in the second station but were pitted after short service in the first. From this experience it would appear necessary to take extreme care with regard to the application of experience with certain tubes in any one installation to some other plant.

Extensive studies of condenser-tube deterioration by the A.S.M.E. Special Research Committee show that a frequent cause of tube failure is corrosion or erosion of the inlet ends of the tubes as a result of turbulence in the condenser water boxes, air impingement at the tube entrance and high velocity of the water flow through the tubes. Any one of these factors may be the individual cause of end corrosion and as they usually occur in combination, correcting the conditions causing any one of them may often reduce the harmful effect of others.

Turbulence in condenser water boxes has been improved by increasing their depth to reduce the velocity of water entering the condenser and relocating and streamlining the necessary braces in the water boxes. Water-flow conditions have also been improved by expanding and flaring the tubes into the tube sheet.

Further reductions in end corrosion have been obtained by installing air-removal equipment to by-pass the gases released from the condensing water as a result of turbulence and negative pressures in the water boxes, by venting the water boxes, pump discharge, and other points to the top of the condenser tail pipe.

Investigation of the methods used for the comparison of tube materials indicate that of the accelerated corrosion test methods in use, the results obtained by the impingement test are most comparable with those in actual practice.

There are two general types of impingement testing in use. In one, jets of aerated circulating water impinge upon sample discs of the tube alloys to be tested, while in the other the discs are submerged in a trough through which circulating water is flowing with jets of air, from nozzles placed below the discs, bubbling up through the water and impinging upon the discs. The velocity of the jets, temperature and velocity of circulating water and other factors may be controlled to show their relative effects upon the rate of corrosion. A simple test method of showing the relative effect of circulating water velocity upon different tube alloys consists of rotating sample

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ELECTRICITY IN TRINIDAD

Power Station and Trolley-bus Schemes

SINCE the Trinidad Electricity Board took over the electricity and transport undertakings of the island in July, 1937, two important projects have been put in hand—the provision of a new power station and the equipment of a trolley-bus route as a preliminary step towards the displacement of the tramways in Port-of-Spain, the capital city.

The Board consists of seven members, with the Hon. Errol L. dos Santos, C.B.E., as chairman, and Mr. W. J. Williams, M.I.E.E., is the general manager. The head offices have recently been largely improved and extended, the old entrance hall being converted into a showroom which has proved a great attraction.

Three years ago Major C. A. M. Henderson, of Messrs. Preece, Cardew and Rider, consulting engineers to the Crown Agents for the Colonies, visited Trinidad to advise the Port-of-Spain Council on electrical matters and to report to the Colonial Government on the practicability of an island electricity supply scheme. His subsequent report stressed the importance of immediate steps being taken to safeguard the supply of electricity in Port-of-Spain by the construction of an up-to-date power station to replace the existing somewhat uneconomical plant serving the city.

Head offices and showroom of the Trinidad Electricity Board illuminated for the Port-of-Spain City Council's silver jubilee last July

The Electricity Board, when constituted, lost no time in adopting this recommendation and it was decided to order one 900-kW and two 1,200-kW Diesel sets, as a first instalment, to be erected in a new power station building, the contract being placed with the English Electric Co., Ltd.

On account of the nature of the ground it was found that piling was necessary under the main columns of the building and the foundation blocks of the machines, and this work was commenced in July last year. Difficulties were encountered owing to the fact that a large part of the building encroached upon the treated water pond supplying the boilers of the existing plant, but by the end of the year the steel structure and the roofing of the building had been completed and the foundation blocks of the three new machines had been cast, while good progress had been made with the 900-kW set.

The main switchgear has been supplied by Ferguson, Pailin and Co., Ltd., and the sub-station switchgear by Crompton Parkinson and Co., Ltd., while all the underground radial cables between the power station and the sub-stations, as well as the pilot and telephone cables, have been supplied and laid by Callender's Cable and Construction Co., Ltd.

Surveying the Board's operations during 1938 Mr. Williams, in his annual report, says that the need for the new plant became very evident towards the end of the year, when the existing plant was taxed to the limit of its capacity, and during Christmas week a considerable overload had to be carried. Pending the completion of the new plant no attempt was made to push the sales of electricity, yet only with great difficulty was rapid development held back. Careful "nursing" of the old plant was necessary, and on several occasions a complete shut-down was narrowly avoided when the power station site was flooded consequent upon the blocking of storm water outlets in connection with the construction of the new deep water wharves and the very heavy rainfall which prevailed. The general public, however, were not inconvenienced and were totally unaware of the struggle to maintain the supply.

The whole of the distribution system in Port-of-Spain is by means of 2,300-V overhead lines with pole-type transformers to give a 110/220 V supply. Although this method possesses certain advantages it is considered that the number of wires crossing the streets is unsightly, and as opportunities arise the high-voltage lines will be placed underground and as far as possible transformers will be housed out of sight. Towards the end of the year the Board approved a report by the general manager on the advisability of constructing a transmission line to Arima, the third largest town in the island, in order to provide a supply of electricity there and to various townships and villages en route.

During 1938 the Board sold 4,603,655 kWh compared with 3,928,697 kWh in the previous year. There was an increase in the net profit from $235,685 to $241,314, although the abolition of meter rents resulted in a loss of revenue of $10,610. The number of consumers rose from 6,998 to 7,699. The house installation department was kept busy and difficulty was experienced on account of the scarcity of qualified wiremen. On this point the general manager comments that there is a great need for the establishment of a good technical school to train youths for the various branches of the engineering profession.

On the transport side, the Board last year approved a report by the general manager on a proposed trolley-bus route in Port-of-Spain, having in mind the eventual displacement of the tramways. The question was considered by the City Council on various occasions and in October last year the recommendation was finally adopted. The operations of the undertaking during 1938 resulted in a deficit of $49,507, but this was an improvement on the previous year when the deficiency was $53,092. The number of passengers carried was 2,846,365, compared with 1,757,683 in 1937.

Steam Condensers (*Concluded from preceding page*)

discs of various metals about 6 in. in diameter while partially submerged in a tank of water to a depth of 2½ inches.

The velocity of the motion of the metal in contact with the water varies along the radius of the disc, being at a maximum at the periphery. The critical impinging velocity for the specimen can be estimated by measuring the radial distance from the centre beyond which the protecting film does not adhere and severe corrosion by pitting takes place. Such tests are useful in checking the characteristics of tube alloys.

Steel plate construction for condenser shells is now generally practised, very few condensers being built with cast-iron shells. In most cases, however, the use of cast-iron for water boxes and covers continues. Steel shells give the benefit of a close grain structure, reducing air leakage and the number of flanged joints which are possible sources of leakage.

The older designs of condensers were invariably provided with an excessive amount of cooling surface resulting in under cooling of the condensate. A number of condensers have been retubed and relaned in the United States, and under cooling has been reduced with a resulting increase of vacuum. For instance, at the Connors Creek station of the Detroit Edison Co. five of the original condensers have been relaned.

Three of these, installed in 1915 to serve 20,000-kW units, now serve 30,000-kW units, the tube surface being reduced from 32,500 to 27,000 sq. ft. One unit installed in 1920 to serve a 30,000-kW set now serves a 60,000-kW unit, the cooling surface being increased from 30,000 to 35,000 sq. ft. The same tubes of Admiralty metal are still in the condensers, having been merely taken out, cleaned and reinstalled. Condensing water treatment with chlorine is so effective in this station that it is seldom necessary to clean condensers. For the 30,000-kW units the power consumption has been decreased by approximately 20 per cent., and the under cooling by approximately 5 deg. F. with the same quantities of steam.

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

"Nobody's Babies"

ALTHOUGH Mr. Banks in his letter published in your issue of December 8th maintains that the above is not a correct description to apply to electrical installation inspectors, it is in the main quite correct. While in some cases, it is true, the designation of electrical installation inspector is included in certain Joint Industrial Councils as an operative position, and in others a rate from the Joint Board Schedule has been selected, the varying conditions throughout the country are evidence of the lack of any approach to uniformity or general support of the contention of Mr. Banks.

To suggest that any grade of employee of technical status would be properly graded under the N.J.B. Schedule is to ignore the fact that the basis of that Schedule has no relation to the duties or responsibilities of many of the employees Mr. Banks has in mind, and particularly the electrical installation inspectors whose position was fully explained in your issue of December 8th.

If we follow Mr. Banks's reasoning to its logical conclusion, it would be quite in order when engaging an accountant to select a grade or class from the Schedule and grade such an official under that Schedule. The fact that there are rates of pay under the Schedule which could apply to various positions is no argument for including such positions under the Schedule or for advertising such positions as "in accordance with N.J.B. Schedule."

A. BRAMMER,
General Secretary,
Association of Supervising Electrical Engineers.

London, W.C.2, *December 19th.*

Current Transformer Errors

Mr. G. F. Freeman. in his article in your issue of December 15th, gives a method of determining the errors of Class A current transformers. He recommends that the compensating turns should be wound on the transformer under test. There are, however, certain factors which, in my view, render this undesirable unless the transformer is of the omnirange pattern.

Most Class A transformers are now made with high-permeability nickel-iron cores, and this material is rather sensitive to changes in pressure. Thus, if the ring has to be removed from its clamps in order to be tested, there may be a difference between the test results and the errors obtaining under working conditions. This is apart from the fact that great care has to be taken in assembling the transformer rings in their clamps or fixing devices. Inexpert reassembly may result in varying stresses on different parts of the core, which would further nullify the test results, and which may have disastrous effects on the stability of the phase displacement angle.

In view of this, when testing transformers on which it is not possible to insert the compensating windings without dismantling, these should always be wound on the "mixer."

December 16th. F. A. AXWORTHY (Sapper).

Rectifier Nomenclature

It is high time we adopted a standard terminology for static converting apparatus. So many authors use different terms for the same application, and the confusion this causes in the average mind is quite unnecessary. So far there is general agreement about the terms to be applied to such apparatus in its two leading forms, viz., "rectifier" and "invertor." But we still need two more standard terms of the same generic nature, one to include *all* forms of conversion by static means, and another for the static frequency convertor.

My own suggestions are (1) to keep the "convertor," pure and simple, for the general term describing all classes of static converting apparatus, and (2) to adopt the term "mutator" for the static frequency convertor. We then get the following general classification:—

Convertors { Rectifiers: Conversion of AC to DC.
Invertors: Conversion of DC to AC.
Mutators: Conversion of AC to AC.

Rotary and motor convertors are rapidly dying out; mercury-arc and, possibly, atmospheric-arc convertors are to-day taking their place. So that there is no valid reason for dropping the simple term "convertor" just because modern apparatus is static (electronic) where its forerunner was rotating (electro-dynamic). The term "mutator" seems a little strange at first, but, after all, we have it already in "commutator."

To those who still wish to distinguish between the rotating and static forms of convertors I would suggest the use of the general term "current convertor" instead of "convertor." For the static method of conversion is essentially one of current and not of energy *per se*, as in the electrodynamic convertor where mechanical energy plays a not inconsiderable part in the conversion process.

Perhaps you or some of your readers have other views on the subject. In that case it would very interesting to hear them.

London, S.W.6, *December 21st.* H. RISSIK.

Condenser Timing for Control Gear

We believe that we are able to contribute to the interest of the paragraph under the heading "Capacity Regulation," which appeared on page 752 of your issue of December 15th, for we have been actually utilising condensers for obtaining time delay in control circuits for some considerable time past. Among the more important applications to which we have been successful in applying this principle are included automatic control for steel mill auxiliaries and for cranes and hoists, and timing control for electric welding.

The various circuits which we evolved were covered by patent applications which we filed some fifteen months ago, and subsequently we were granted the trade mark "CondITLe" in respect of our developments under condenser timing control. This trade mark links up in one word the principles of condenser control and inductive time limit control, the latter being perhaps more familiarly known under the initials "I.T.L." The new trade mark supplements our earlier registration of the mark "IgranITL" which is applied to this company's standard system of inductive time limit control.

Under the new "CondITLe" system we make use of one or more condensers to work in conjunction with the hold-out coil of our standardised inductive time limit contactors, and in this way we are able to obtain a very wide range of timing which is flexible in adjustment to meet widely varying conditions and provides positive and responsible control for industrial motor drives.

We think it will be some satisfaction to you to learn that the American practice which you referred to in your article has already been the subject of contemporary development in this country.

IGRANIC ELECTRIC CO., LTD.
Bedford, *December 21st.* R. K. Fleming.

I.E.E. Programme

THE Institution of Electrical Engineers announces that the programme for the second half of the 1939-40 session is as follows:—

January 25th.—Discussion on "Fire-fighting Equipment for Electrical Installations" (based on the E.R.A. report published in the I.E.E. *Journal* for December) illustrated by a cinematograph film, introduced by Messrs. H. W. Swann, J. Hacking and R. A. McMahon.

February 8th.—"Telegraph Typesetting," by Mr. H. H. Harrison, with cinema film and demonstration.

February 22nd.—"Insulating Stresses in Transformers," by Mr. H. L. Thomas, with demonstration.

March 7th.—"Oil-less Metal-enclosed Switchgear for Medium-voltage A.C. Circuits," by Messrs. H. E. Cox and L. Drucquer.

March 28th.—"The Limitation of Transformer Noise," by Messrs. B. G. Churcher and A. J. King.

April 11th.—"The High-rupturing-capacity Cartridge Fuse, with special reference to Short-Circuit Performance," by Mr. J. W. Gibson.

April 25th.—The thirty-first Kelvin Lecture, by Dr. C. G. Darwin.

May 9th.—Annual general meeting.

Mining Electrical Engineers

THE written examinations of the Association of Mining Electrical Engineers are to be held in Cardiff in April and May next year. The last oral examinations of the present series for electricians in electrical subjects will be held on a date before December 30th. Particulars can be obtained from the hon. secretary of the branch, Mr. H. J. Norton, 89, St. Mary Street, Cardiff.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

ABOUT 1,500 night workmen of the Metropolitan-Vickers Electrical Co., Ltd., at Trafford Park, at 1.30 a.m. on December 21st, sat down to a Christmas dinner in their canteen. An orchestra, consisting of night-shift members of the Metrovick orchestra, played throughout the dinner, which was followed by concert items rendered by other night-shift workers and an exchange of greetings beween the night shift and the management, represented by Sir Felix Pole, chairman of the company, Mr. G. E. Bailey, director and general manager of works, and senior members of the staff.

Day workers who had mid-day meals in the company's canteen had special turkey and Christmas pudding dinners provided during Christmas week, and similar provision was made specially for the night shift. The work involved in providing the Christmas dinners, which totalled over 6,000 during the week, in addition to maintaining the ordinary service of about 4,500 dinners each day, may be imagined. The provisions for the night-shift dinner alone included thirty-five turkeys and 200 Christmas puddings.

Mr. A. G. Connell, A.M.I.E.E., M.I.Mech.E., M.A.Min.E.E., whose appointment as borough electrical engineer has now been confirmed by the Halifax Corporation, received his technical training at Erith Technical College, and served an engineering pupilage at Fraser & Chalmers Engineering Works, Erith. From 1914-1918 he was with the Royal Engineers, and on returning to civil life joined the English Electric Co., Ltd., with whom he was engaged for two years on steam turbine design.

On the formation of the Foundation Co., Ltd., he had charge of large power station construction and civil engineering contracts carried out by that company, including the Lydney power station of the West Gloucester Power Co., the hydro-electric power station on the equator of the East African Power & Lighting Co., the Brimsdown "B" station, and the erection of the London Regional and National wireless masts at Brookmans Park. In 1930 Mr. Connell joined Merz & McLellan and became resident engineer, northern area, of the Central Electricity Board's S.E. England scheme, including the main Thames overhead crossing at 130,000 V. He was also technical representative of the Board in connection with compensation claims.

Mr. A. G. Connell

He joined the Staveley Coal & Iron Co. as chief electrical engineer in 1934, and since holding this position has carried out extensive developments, including large electrolytic plant, electrical control of blast furnaces, chemical works and colliery conversion, and general distribution of power in bulk for domestic purposes, including the export of bulk supply to the Derby & Nottinghamshire Electric Power Co.'s selected station at Spondon. Mr. Connell is on the I.E.E. Sheffield Sub-Centre Council, and is this year's president of the Midland Branch of the Association of Mining Electrical Engineers. Early this year he was asked by the Secretary for Mines to serve on a select technical committee of four for revision of the Mines Act and to review the Electricity Regulations in the light of the Royal Commission's Report. Mr. Connell takes up his new duties in the middle of March, or sooner, providing a suitable successor can be found at Staveley.

Mr. T. W. Morgan, sub-station superintendent, and **Mr. A. T. Bannister,** senior installation inspector, with the Walsall Corporation Electric Supply Department, have been presented with wristlet watches to mark completion of twenty-five years' service with the Department.

Mr. G. D. Poole, assistant mains engineer with the Beds, Cambs, and Hunts Electricity Co., St. Neots, son of Mr. S. G. Poole, mains superintendent with the Peterborough Corporation Electricity Department, was married recently at Roxton, St. Neots, to Miss A. M. Hayman, who has been with the same company for some time.

Mr. A. Stuart Allen has joined the board of Siemens-Schuckert (Great Britain), Ltd., Brentford. He is the senior partner of Allen, Baldry, Holman & Best, Incorporated Accountants, and is well-known in the city, where he is regarded as an authority in taxation matters.

Mr. P. Wardle, of Cannock, who was recently appointed engineer and manager of the Macclesfield electricity undertaking, has asked to be released from that position. He is to remain as chief electrical engineer at Cannock at a higher salary. The Macclesfield Electricity Committee has acceded to his request and has decided to appoint **Mr. P. Clegg,** B.Sc. (Tech.), A.M.I.E.E., at present engineer and manager at Morecambe and Heysham, as electrical engineer at Macclesfield. Mr. Clegg was appointed to his Morecambe position in 1933.

Obituary

Mr. J. Simpson.—The death is reported in the *Electrical World* of Mr. James Simpson, which occurred on November 25th at Chicago at the age of sixty-five. Mr. Simpson was chairman of the Commonwealth Edison Co., Public Service Co., of Northern Illinois, Commonwealth Subsidiary Corporation, and the Public Service Subsidiary Corporation. Born in Glasgow, he went to the United States in 1880, and entered the employ of Marshall Field & Co. as a clerk in the cashier's office in 1891. He was serving as chairman of the board when he resigned in 1932 to undertake the salvaging and reconstruction of the utilities system of Mr. Samuel Insull.

Mr. Charles Mac Fiander, B.Sc. (Eng.), A.M.I.E.E., sales engineer to the Swansea Corporation Electricity Department for the past four years, died recently. Prior to going to Swansea Mr. Fiander was with the North Wales Power Co., at Wrexham and London.

Mr. T. Evan Jones, a member of the Economic Electric Company (Liverpool), Ltd., Liverpool, died last week. He had been a member of the Birkenhead Town Council for the last eight years.

Mr. F. W. Clements.—In reporting the death of Mr. Clements in our last issue, we should have stated that he was *late* chairman of the State Electricity Commission of Victoria, from which position he retired in 1937. The present chairman of the Commission is Mr. G. G. Jobbins.

Fire Causes in America

OF all fires in the United States and Canada during 1936 and 1937 (excluding those caused by lightning) 11.2 per cent. were of electrical origin, and the loss was 10.9 per cent. of all fire loss. These figures, from the records of the National Fire Protection Association, were contained in a paper by G. S. Lawler which was presented at the Fire Service Extension School, Morgantown. For all types of property, electricity ranked third as a cause of fire bct it was first for industrial plants. From 1931 to 1938 inclusive, 19.8 per cent. of the fires for which claims were made in "Factory Mutual" plants were caused by electricity, and the loss was 19.2 per cent. of their total fire loss.

The amount of electrical equipment in industrial plants is much larger than the average for all classes of property throughout the country. The following figures, obtained from the Factory Mutual Appraisal Division, give values of electrical equipment as percentages of the total insured values for several different kinds of modern manufacturing properties: Fully electrified newsprint mill, 20.6; up-to-date cotton mill, 4.1; hosiery mill, 3.7; lace curtain mill, 4.1; average machine shop, 2.8; rubber product manufacturing plant, 7.6; large plant producing electrical apparatus, 12.0; laundry, 6.4.

Wiring is responsible for 41.2 per cent. of all electrical fires; this includes all transmission, distribution and branch circuits in yards and buildings, with accessories. The resulting loss amounts to 66.4 per cent. of all electrical fire loss; this high proportion is because fires of this class are more likely to spread and cause sprinklers to discharge water.

An additional 27.7 per cent. of all fires of electrical origin start in motors, but they cause only 16.7 per cent. of the electrical fire loss, since they are usually confined to the machines. Motor controllers, starters and circuit-breakers cause about 16.6 per cent. of Factory Mutual electrical fires and 7.8 per cent. of the total electrical fire loss. Lighting is the cause of an additional 5 per cent. of claims for damaged electrical equipment. Before the depression (*i.e.*, from 1926 to 1930 inclusive) the average yearly number of fires of electrical origin was only 16.5 per cent. of the number of all fires, while the loss caused by these fires was 17.6 per cent. of the total fire loss. The increase in the number of electrical fires since 1931 (12.4 per cent.) is attributed to the reduction of maintenance during and since the depression.

INSTITUTION PROCEEDINGS

Electrically-produced Music. New Oscillographs

Electronic Organs

IN a paper issued by the Institution of Electrical Engineers various electrical aspects of the design and development of pipeless organs operating on electronic principles are discussed at some length. The authors are Mr. G. T. Winch (research laboratories of the General Electric Co., Ltd.) and Mr. A. M. Midgley (Midgley Harmer, Ltd., and Midgley Electrical Instruments, Ltd.), who commence by briefly tracing the history of musical scales and the development of the more traditional forms of musical instruments.

The principles governing the design and operation of the pipe organ are dealt with in relation to the engineering problems associated with the possibilities of electronic methods of producing music. By such methods electric currents can theoretically be generated of any desired frequency and harmonic content. These, amplified and converted to sound-pressure waves by means of loudspeakers over an almost infinite volume range, provide a flexibility of control and constancy of tuning that exceed those of any existing musical instrument and at a small fraction of the cost and bulk of a pipe organ.

Photographs are reproduced and circuit diagrams are given of the components of an electronic organ incorporating rotary electrostatic generators of which details are described. The layout of the keyboards and controls is in accordance with the standards of the Royal College of Organists and the dimensions of the complete console, without pedal board, are 49 in. high by 62 in. wide by 29 in. deep.

As to future developments, while the more immediate attention of designers will be directed towards perfecting details it is expected that surprising improvements will follow from the increased range of tone colours and effects, which can be altered to suit theatre requirements instead of attempting to imitate church organs. A possible development is the use of a cathode-ray method of wave-form generation, but it is not yet clear that the advantage of the absence of moving parts would not be outweighed by the more elaborate nature of its components.

Chairmen's Addresses

FAULTS on power cables and overhead lines was the subject of Mr. M. Cline's (North-Eastern Electric Supply Co., Ltd.) inaugural address as chairman of the Tees-side Sub-centre of the Institution of Electrical Engineers. The causes of some of the more generally experienced faults are enumerated and methods of localising them are described, reasons being mentioned for preferring some tests rather than others.

In his address as chairman of the I.E.E. Dundee Sub-centre Mr. A. A. B. Martin (Central Electricity Board) discussed electricity in relation to national affairs. Of its two roles, that of existing in an individualistic way was subordinated in times of danger to that of existing as part of a community, or as a collective national machine. Could it be doubted that the cumulative effect of such combined efforts would achieve results past all comparing with normal evolutionary results? It was being discovered now how important was the need for a much wider outlook; and the benefits still awaiting to be reaped would depend on how much further fields of knowledge had already been harvested.

AC Network Analysis

IN the I.E.E. *Journal* for November an oscillographic technique for measurements in AC network analysis is described by Dr. D. M. Myers and Mr. W. K. Clothier (Australian National Standards Laboratory). Two methods are described: both are new and employ a cathode-ray tube.

One is a null method, the amplifiers and oscillograph together forming a highly sensitive indicator whose function is to register the equality between the unknown and the intermediate voltages. Since this equality can be adjusted with great precision, the accuracy of the measurement must be determined mainly by the precision with which the intermediate voltage is known in terms of the standard, and this in turn depends upon the accuracy of the phase-shifter and the potential divider. These instruments can be constructed and calibrated with a high degree of precision and great accuracy is therefore possible when using this method of measurement. Quite a small cathode-ray tube is adequate, since measurements are made when the trace on the screen is reduced to a straight line.

The second is a coincidence method, the accuracy depending largely upon the precision with which the two waves can be superimposed; this is affected by the size of the oscillograph diagram and the harmonic content of the waves. Thus a large screen diameter is desirable, while the effect of harmonics could be reduced by inserting tuned circuits in the pre-amplifiers to the electron switch, but this would not be justified unless the harmonic content were considerably greater than one per cent. The coincidence method may be used for analysis of non-linear networks, allowing the comparison of a distorted network voltage or current with the generator EMF.

The equipment, with slight modifications, may also be used in the transient analysis of networks. The transient current or voltage concerned is recorded photographically, together with the changing EMF which produces the transient. The electronic relay switch is operated at a frequency considerably higher than the generator frequency, so that each curve is composed of small dots. A single-sweep linear time-base provides the time scale.

The authors carried out this work in the Department of Electrical Engineering, P. N. Russell School of Engineering, University of Sydney, through their association with that Department and with the Radio Research Board of the Australian Council for Scientic and Industrial Research. The equipment was developed at the request of the Sydney County Council electricity undertaking and was constructed in its workshops.

Pure Synthetic Resin

THE dielectric characteristics of samples of a chemically pure synthetic resin (glycolphthalate) are discussed by Mr. C. G. Garton (Electrical Research Association) in a paper published in the I.E.E. *Journal* for November. The author's conclusion is that the practical advantages of a pure resin as compared with one containing two or three per cent. of impurity are negligible, unless the lowest possible conductivity is required. The experimental work described in this paper was done at the All-Union Electrotechnical Institute at Moscow, U.S.S.R. The major part of the theoretical work was developed after the author's return to England, with the aid of the E.R.A. computing staff. Appendices describe the method of preparing the chemically pure resin used; also a 50 kc/s inductance bridge circuit (push-pull oscillator) found convenient for measurements involved in this investigation; and the computation (which does not seem to have been previously attempted) of a certain integral which occurs in the prediction of the loss angle.

Oil-filled Cable Leakage

NORMAL methods of locating oil leaks in single-core oil-filled cables depend on precise measurements of relative quantities (usually small) of oil flowing to waste along two paths of a loop formed by the faulty and a similar sound cable.

In a new method, devised by the engineering staff of British Insulated Cables, Ltd., restrictions to oil flow are interposed in the oil supply connection to the testing end of each cable. These restrictions consist of small-bore tubes or, alternatively, valves, the opening of which may be closely regulated. Pressure is applied to the oil and the drop in pressure across each restriction is measured by means of a "U" tube gauge. The arrangement is thus analogous to a shunted ammeter.

It is claimed that location by this method is both rapid and accurate, whilst the test may be applied at any point of the system, also that the application of increased oil pressure enables a small leak to be magnified sufficiently to obtain a reading with reasonable facility. Correction for normal flow due to temperature variation may be made by taking a similar reading simultaneously on the third cable with its farther end closed to oil.

Blue Flash-lamps in France

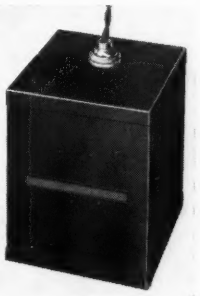
THE difficulty experienced at the outset of the war in obtaining flash-lamps has considerably abated and nearly everyone in Paris now has one. The increasing use of such lamps when a raid warning is sounded at night is considered to be likely to reveal the positions of shelters, and in future, therefore, all pocket lamps used in the streets, particularly during a raid, must either have blue bulbs or be covered with blue varnish or cloth to render them less visible.

NEW ELECTRICAL PRODUCTS

A Review of Equipment Recently Marketed

Shop Window Lighting

THE shop window lighting box fitting which SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, London, E.C.4, have produced to comply with the new regulations relating to general shop window illumination has been designed in a collapsible form to facilitate storage, packing and transport. The method of assembly is quite simple and once made up there is no need to take it apart again. For lamp replacement it is only necessary to remove the bottom.

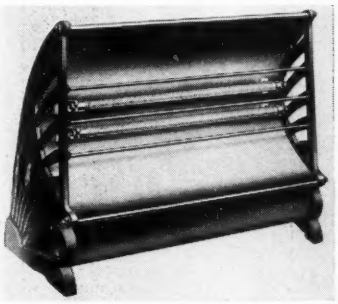


Siemens shop window lighting fitting

Another concern which is now supplying window lighting boxes is L. G. HAWKINS & Co., LTD., 30-35, Drury Lane, London, W.C.2, which also has available special "Supreme" fittings for use in the display cabinets now permitted and also a range of illuminated signs and a new A.R.P. hand-lamp. This hand-lamp, which conforms with BS/ARP3, is of sheet-metal construction and holds a 2-V, 20-Ah jelly acid accumulator.

Reflector Fire

Attractive end castings are a feature of the "Reflex" reflector fire, the latest addition to the range of units offered by the MIDLAND ELECTRIC MANUFACTURING Co., LTD., Tyseley, Birmingham. Both 1- and 2-kW models are available, the larger fire having a switch to control one of the elements. A novel handle permits the tidy disposal of the flex when the fire is not in use. Construction is robust and the finishes available—bronze, cream or oxidised silver — harmonise well with almost any colour scheme. The reflector is of brass, heavily chromium plated.



M.E.M. "Reflex" fire

Pressure Controls

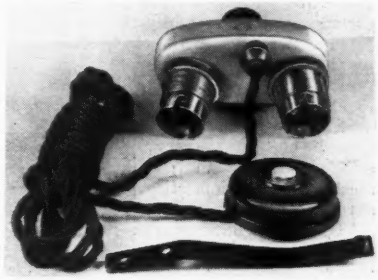
To its already extensive list of "Teddington" pressure-operated switches the BRITISH THERMOSTAT Co., LTD., has added two new models, which greatly extend the range of working pressures for which standard instruments can be supplied. Pressure-stat "K16," which is arranged for operation on very low pressures up to 10 in. water gauge with a differential of 3 in. water gauge, comprises a diaphragm chamber and change of pressure actuates a 15-A mercury tube switch. The instrument is contained in a substantial die-cast metal case, and both the cut-in and cut-out pressures can be adjusted.

"Teddington K.16" pressure control

At the higher end of the pressure range is model "FZ," which consists of a Bourdon tube movement actuating a 5-A mercury-tube switch. Standard pressure ranges are any 100 lb. per sq. in. up to a maximum working pressure of 250 lb. per sq. in. The inherent sensitivity of the Bourdon tube and the special design of the mercury switch permit the instrument to work on very fine differentials, down to a minimum of 5 lb. per sq. in. The value of this feature in the control of boiler installations is that it makes possible a considerable reduction in the overall differential of the installation in spite of the considerable "over-run" normally experienced with boilers.

Black-out Door Switch

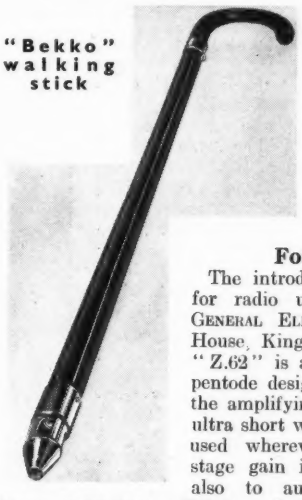
A door switch marketed by W. H. ALLAN, LTD., 78, Hampstead Road, N.W.1, is arranged so that the ordinary light is switched on and remains alight while the door is closed, a safety light coming into operation as soon as the door is opened. The switch is actuated by a striker pressing on to a push-button mounted at the side of the door, a special twin lampholder being supplied to plug into an ordinary lamp socket. As an alternative the lampholder can be fitted with a pear switch for use as a light-saving device in such places as bedrooms, halls, staircases, landings, nurseries, &c. It is also most useful for photographic dark rooms.



Allan door switch

A.R.P. Walking Stick

The "Bekko" walking stick with a light in the ferrule is likely to prove popular for use during the black-out. The lamp is operated by a push-button switch near the handle, a standard-size torch battery being housed in the base. The light is directed downwards along the surface of the ground, no upwards rays being emitted. This novelty is made by BERRY'S ELECTRIC, LTD., 85-86, Newman Street, London, W.1.



"Bekko" walking stick

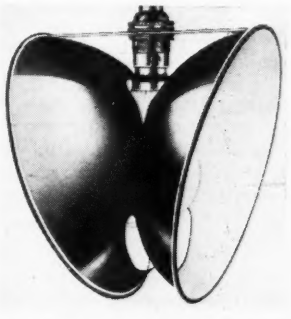
Four New Valves

The introduction of four new valves for radio use is announced by the GENERAL ELECTRIC Co., LTD., Magnet House, Kingsway, London, W.C.2. The "Z.62" is a high slope R.F. screened pentode designed primarily for use in the amplifying stages of a television or ultra short wave receiver, but it may be used wherever a comparatively high stage gain is desired, being applicable also to audio frequency amplifiers. Types "HD.24," "X.24" and "KT.24" are 2-V battery operated valves, which are intended to replace the "HD.23," "X.23" and "KT.21" types. They have the same characteristics as their predecessors, but consume less current.

Bin Lighting Unit

A novel "Mazdalux" fitting has been designed by the BRITISH THOMSON-HOUSTON, Co., LTD., in order to facilitate the lighting of storage racks, &c., situated on each side of a gangway. The unit consists of two specially designed reflectors back to back and inclined slightly downward. The lamp is situated in the centre and the light is thus directed equally on to the shelves or bins each side.

A slot is provided immediately under the lamp to light the floor of the gangway, but the slot extends only through an arc of 140 degrees thus providing a 20 degrees cut-off, in compliance with the requirements of the 1937 Factory Act and accepted principles of good lighting. The fitting must not



"Mazdalux" bin lighting set

(*Continued at foot of page* 818.)

HORNSEY'S NEW SHOWROOMS

Encouraging the Use of Fluorescent Lighting for Window Displays

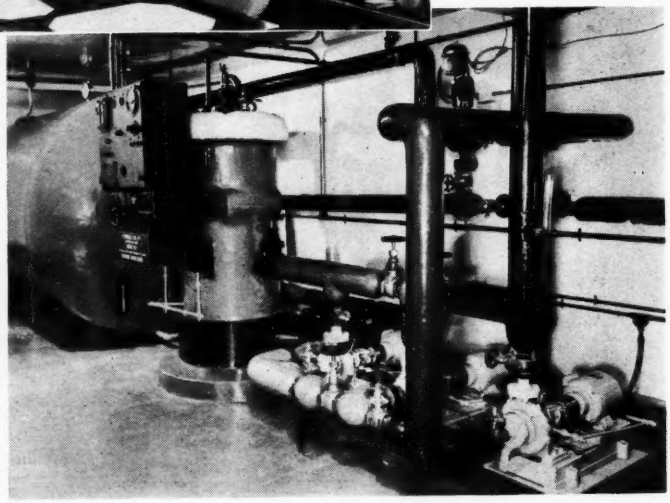
THE value of the new central showrooms and offices which the Hornsey Corporation Electricity Department has just opened in the Broadway, Crouch End, is somewhat reduced by the fact that about a quarter of the accommodation, including the demonstration theatre, half the main showroom and the stockrooms, has been commandeered by the local food and fuel controllers. Enough of the premises remains, however, to provide a very useful addition to the facilities at the disposal of consumers, and when the war is over the Department should be in a very strong position to go ahead with its domestic development programme.

The new showrooms adjoin the new town hall opened about four years ago and have been designed as part of a civic centre scheme. Their corner site provides a window frontage of over 100 ft. and the almost complete glass front will give an unobstructed view of the whole of the main showroom when fuel control and black-out restrictions are things of the past. The entrance to the showrooms is on the main shopping thoroughfare and in the light lock effective use has been made of fluorescent lighting, both to indicate the way in, and also as a means of advertisement. Mr. F. C. Orchard, the borough electrical engineer and manager, is in fact making a special effort to popularise this form of lighting among local traders for display purposes, and has just completed three demonstration windows in the lighting showrooms on the first floor. A window containing confectionery is particularly effective since many sweets are naturally fluorescent, while treatment of the designs of the boxes and ribbons adds further appeal. Small electrical appliances and miscellaneous small goods, including jewellery, &c., have been chosen for the other two windows.

The main showroom of which, as already mentioned, only half is now available for the Department's use, measures nearly 80 ft. long. All down the right-hand side are the window displays, which, however, can be screened off by net curtains if privacy is desired. A raised platform on the left provides a prominent position for displaying any apparatus to which it is desired to draw particular attention. There are various display tables in the centre of the showroom and at the end further show cases and a desk for clerical work. Half-way up the tubular suspension staircase which leads to the lighting showrooms referred to, and also to the offices, is an illuminated panel containing a selection of some of the more popular small appliances. A separate entrance from the roadway is provided for the offices and the demonstration theatre, with another door into the other end of the showroom. The demonstration theatre has its own preparation kitchen at the rear.

To heat the building a 150-kW Reyrolle electrode boiler supplying a 2,000-lb. storage cylinder is employed. An extremely neat arrangement of Holden & Brook centrifugal pumps (each driven by a ¾-HP, 1,435-RPM Crompton Parkinson motor) enables one unit to be available as a spare for either primary or secondary pumping. A Drayton mixing valve is operated by a thermostat situated outside the building and all the usual protective features are provided, as well as a time switch for cutting the supply off at peak periods. The use of copper conduits, polished and varnished, give the boiler house a remarkably smart appearance. For providing hot water in the lavatories, Johnson & Phillips "Charlton" self-contained units of various capacities are employed.

The whole of the electrical installation work was carried out by the Electricity Department's own staff under Mr. Orchard's direction, G. N. Haden & Sons, Ltd., being the contractors for the heating work.



A corner of the main showroom at the new Hornsey premises and (below) the thermal storage heating plant

The cables used were mainly St. Helens and Henley's, with Simplex conduits. For the staircase well and some of the offices a "Philora" A.R.P. complementary light obscuration system, utilising sodium lamps and blue painted windows, has been employed to good effect. Lighting elsewhere is provided by fittings supplied by Best & Lloyd (for the demonstration theatre), Troughton & Young (louvre type for the shop windows), C. Harvey & Co. (exterior units), J. Starkie Gardner (external sign), and S.L.R. Electric (spherical office fittings). A Harcourt combined pendant lighting and heating unit is installed in Mr. Orchard's office. Ferranti clocks, Telephone Rentals telephones, M.K. switches and plugs, and Reyrolle main switchgear are fitted.

New Electrical Products (*Continued from preceding page*)

be allowed to rotate and should be held by means of a conduit entry shade ring lampholder. At present a 60-W unit is the only size available.

Illuminated Signs

The "Union" signs made by the UNION LAMP & LIGHTING CO., LTD., Abbeydale Road, Wembley, for use in shop windows, cinemas, theatres, &c., and for A.R.P. indication purposes, incorporate special glow-lamps which give a violet light from nickel alloy wire letters encased in glass tubes 40 or 50 mm. in diameter. These tubes, which are supplied in lengths of from 10 in. to 2 ft. 6 in., single or double, contain rare gases under pressure, and being hermetically sealed will last indefinitely.

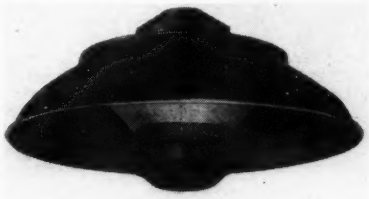
"Union" glow lamp sign fitted with enclosed cowl deflector

Consumption is only 1 to 6 W, according to the number of letters and the diameter of the tube. The signs can be run off AC supplies of any voltage, a coil being provided if it is desired to operate them from DC mains or from batteries. Fitting is very simple and an important feature is that the signs can be quickly converted to a brilliant red display when the black-out restrictions are removed.

STREET LIGHTING

Low Intensity Fittings Now Available

FOLLOWING publication of the draft of the B.S. Specification for low intensity street lighting units (BS/ARP 37), manufacturers have been quick in placing on the market fittings to comply with the new requirements. As reported in last week's issue of the ELECTRICAL REVIEW the Specification provides for a general level of illumination of 0.0002 ft.-candle on a horizontal surface at road level and nowhere on the road must the illumination exceed 0.0004 ft.-candle. Any lantern used for street lighting must be within limits specified by three sets of limiting vertical distribution curves associated with various mounting heights, and must give a relatively uniform illumination along the road.



Holophane "302" street lighting unit with weatherproof hood

The smallest general service lamp available is 15 W, which gives a mean spherical candle power of approximately 10, so that it is necessary to provide a lantern which will reduce the bare lamp intensity at 75 deg. by one-tenth and at 0 deg. by over a sixtieth. The "302" unit produced by HOLOPHANE, LTD., 2, Elverton Street, Vincent Square, London, S.W.1, achieves this in a most effective manner. The fitting, which can be used at mounting heights of 10, 15 or 20 ft., consists of a metal lantern with a light-reducing cylinder enclosing the lamp to pass the requisite amount of light flux to give the maximum intensity at angles from 65 deg. to 85 deg. to the vertical. The central cylinder has a metal cap at the bottom and a secondary light baffle consists of an inverted cone which extends around the cylinder from a short distance above the metal cap to the top of the lantern.

The lantern, which is made of heavy gauge metal, is 10 in. in diameter. The combination of the bowl shaped reflector and the conical and cylindrical light baffles ensure a large area of low luminosity that is a distinct aid to vision, while the design provides for a cut-off below the horizontal. These fittings are made with various adaptations to enable them to be used in conjunction with standard street lighting lanterns.

The unit illustrated is a complete fitting with weatherproof hood on top for use where no existing street lighting lantern is available.

The upper and lower limits of lantern light distribution imposed by the Specification require a precision design of lantern, and since the slightest distortion of the optical arrangement will cause the distribution to fall outside the limits, the construction must essentially be such as to prevent this. The BRITISH THOMSON-HOUSTON CO., LTD., has recognised the necessity for providing an article which will not only meet the Specification initially, but which will continue to do so throughout its period of service, despite the handling it may receive during cleaning and lamp replacement.

B.T.H. lantern with weatherproof hood

A lantern has therefore been designed depending for its precision and permanence of performance on the use of die-cast parts, which are accurate to a thousandth of an inch, and which cannot be deranged or distorted by even the roughest handling. The fitting is intended for use with pearl lamps of 15 W for mounting heights of from 9 to 14 ft. and 14 to 19 ft. and 25 W for mounting heights of 19 ft. and upwards.

The B.T.H. lantern, which has already been tested and approved by the British Standards Institution, can be supplied completely assembled and wired to its own adaptor for screwing into suitable existing lamp sockets, or alternatively threaded 1¼ in. b.s.p. for screwing direct on to the bracket arm. Access for cleaning, etc., can readily be gained and no adjustments are necessary at any time to allow for normal tolerances. The distribution is produced from secondary sources of low brightness, and the bare lamp is not visible.

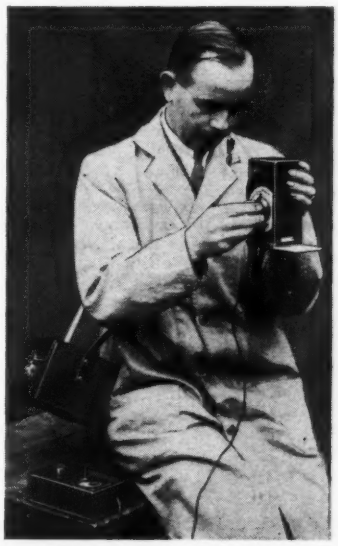
Ease of attachment to existing lanterns is a feature of the GENERAL ELECTRIC CO.'s fittings, which are simply fixed to the reflectors without removing the lanterns. The weight of the fitting is thus carried by the lantern body and not by a lampholder which would not be strong enough for the rough conditions of street lighting. Provided that the lantern itself is upright the fixing suggested by the company will ensure compliance with the Specification, but unless the lantern is rigidly fixed, steps must be taken to prevent it from swinging.

In main streets where the lanterns are usually supported on high columns or traction poles a considerable amount of vibration and windage is to be expected. The G.E.C., therefore, considers that it is inadvisable to use lamps of as low as 15 W and that the slightly higher current consumption of a 60-W lamp is likely to be more than counterbalanced by the greater reliability and consequent saving in maintenance of a more robust higher wattage lamp. In side-street lighting the danger from vibration, &c., is probably smaller and possibly lower wattage lamps can safely be used, but even here it is suggested that at least 25-W lamps should be used.

Preliminary details of the "Ediswan" fitting for A.R.P. street lighting issued by the EDISON SWAN ELECTRIC CO., LTD., 155, Charing Cross Road, London, W.C.2, state that it will be available both as a separate unit for bracket mounting or alternatively with b.c., e.s. or g.e.s. adaptors for existing lanterns. It employs a special fitting to take 15-W pearl lamps, with vitreous enamel reflecting surfaces.

Measuring the Light

Measuring the lighting presents a new problem for the photometrist. Previously, outdoor measurements down to 0.01 foot-candle were regarded as exceptional. Now, determinations down to 0.0002 foot-candle are required. EVERETT EDGCUMBE & CO., LTD., Colindale Works, Hendon, N.W.9, have attacked this problem from three directions. They have modified their well-known luxometer (visual) photometer so as to cover the whole range of black-out measurements, and they have also succeeded in so far increasing the sensitivity of their photo-electric street lighting photometer as to give a full scale deflection with as little as 0.01 foot-candle.



Everett Edgcumbe A.R.P. photometer

Two other entirely new models are a true A.R.P. photometer and an A.R.P. illumination gauge, The former is an extremely compact and simple visual photometer, enabling measurements from 0.0001 up to 0.3 foot-candle to be made, while the latter is a limit gauge.

The photometer comprises a small box containing an inclined screen illuminated by a standardised lamp which is connected to a small dry battery. A regulating resistance and voltmeter ensure that the voltage at the lamp terminals is correct and the photometric balance is obtained by varying the angle at which the light from this lamp strikes the internal comparison surface. Three ranges are provided by means of neutral filters and the direct-reading scale is logarithmic in characteristic, being extremely open at the lower end.

The A.R.P. gauge is essentially a simplified form of the photometer just described, the chief difference being that, since intermediate readings are not required, no scale is provided and the internal comparison screen is fixed, the various settings being obtained by means of carefully adjusted neutral filters. The change of setting is made by rotating a milled disc. The photometer and the gauge each measure only 3 in. by 6 in. by 2½ in., and are provided with a shoulder strap carrying case.

COMMERCIAL and INDUSTRIAL NEWS

Electricians' Wages Increased. Suspension of Rationing Scheme. Electrical Equipment Pool. Australian Import Licences. Commercial Copper Classification. Australian Electrical News.

Hammersmith Apprenticeship Scheme

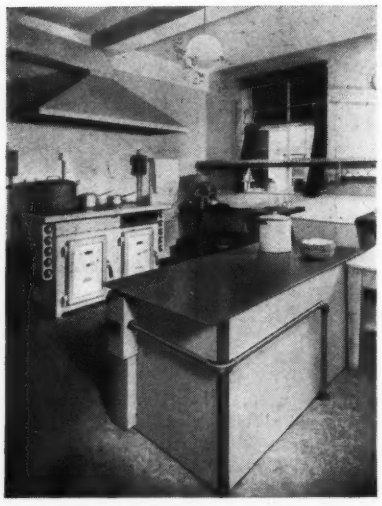
THE adoption of an apprenticeship scheme for the Electricity Department has recently been under consideration by the Hammersmith Borough Council Electricity Committee. In a report on the subject the opinion is expressed that it is desirable that facilities should be afforded to provide a thorough training for a limited number of apprentices extending over five years, excluding periods of service with H.M. Forces. On completion of training it is considered that the apprentices should leave the Council's service in order to obtain further experience and broaden their outlook. Apprenticeship would start at about the age of sixteen, and it would be a condition that the candidate, who must have passed the matriculation examination or its equivalent, must attend classes at an approved London Polytechnic. The proposed wages range from £1 10s. in the first year to £2 10s. in the fifth year.

Wages in the Contracting Industry

The National Joint Industrial Council for the Electrical Contracting Industry announces that as from the second pay day in January, for the pay period covered by that pay day, the cost of living (war) will be 5s. 10d. per week. This rate will remain in force up to and including the first pay day in April; it replaces the interim addition of 3s. 6d. agreed upon in October. The extra payment is made upon rates stabilised for the period of the war, which are as follows:—Grade "A," 1s. 9½d. per hour (subject to an addition of 5 per cent., making 1s. 10½d.); Grade "B," 1s. 7½d. per hour (plus 1s. per hour in lieu of travelling time in the Mersey district); Grade "B2," 1s. 7d. per hour; Grade "C," 1s. 6½d. per hour.

G.E.C. Activities

On December 18th the G.E.C. establishment at Cardiff moved from its quarters in Womanby Street, which it has occupied for over thirty years, to new premises near the Civic Centre, where the address will be Magnet House, Kingsway, Cardiff. The new building occupies a commanding position at the corner of Kingsway and Greyfriars Road, close to the principal municipal buildings, Law Courts, and National Museum. It comprises a basement, ground floor and three floors above. The basement has been planned for extensive showrooms, and although owing to the war these have had to be somewhat restricted they still comprise a complete and representative display of G.E.C. electrical equipment, fittings, radio and domestic appliances. The trade counter is approached from a separate entrance in Greyfriars Road, and the service department for radio, cookers and electrical appliances is adjacent to it. The Cardiff branch is the principal of the company's chain of branches in the South Wales area, the others being at Swansea, Bristol and Gloucester.



G.E.C. double-oven range and hotcupboard at Bethnal Green Town Hall

One of the finest modern buildings in the East End of London is the new extension to the Town Hall of the Metropolitan Borough of Bethnal Green, of which the first portion was opened recently. This four-storey building has a main frontage of Portland stone, about 200 ft. long, and its imposing appearance is well matched by the interior decoration and equipment. In connection with the electrical equipment of the building Mr. E. E. Jolly, M.I.E.E., A.M.I.Mech.E., borough electrical engineer and manager, acted as consultant and designed a very complete electrical scheme. For the Council Chamber itself the lighting equipment was supplied by the General Electric Co., Ltd. An average intensity of 8 ft.-candles is provided at desk level. The main illumination is derived from twelve enclosed pendant fittings, employing "Superlux" globes, 16 in. in diameter, with sand-blasted plate-glass discs with clear edge and rod suspensions finished in real bronze colour; each accommodates a 300-W "Osram" lamp. Three of these fittings, measuring 3 ft. 6 in. overall, are placed over the Mayor's dais; six measuring 7 ft. 6 in. in the body of the chamber; and three measuring 5 ft. 6 in. above the gallery. Supplementary lighting is provided by six wall brackets employing half P.L.A. reflectors in metal housings finished to match the pendants, each containing one 500-W "Osram" Class B projector lamp. Under the gallery are provided two 12 in. ceiling fittings, employing "Superlux" glassware with metal canopy finished to match the other fittings; each is equipped with three 60-W pearl "Osram" lamps. The total loading is over 8,000 W. A staff kitchen on the second floor is electrically equipped throughout. The apparatus installed includes a double oven range, a hot-cupboard with heated top, a twin-pan fish fryer, and a vegetable boiler complete with colanders, all of which were manufactured and supplied by the G.E.C., the total loading being over 40 kW. In a supplementary kitchen on the ground floor is installed a further G.E.C. hot-cupboard. The whole of this equipment was supplied in de luxe finish of vitreous enamel and chromium plate. The electrical contractors were Anderson Angell & Co., Ltd.

Australian Import Licences

Under the Australian Customs (Import Licensing) Regulations, which came into force on December 1st, a prohibition is placed on the import of goods except under licence from all non-sterling countries. Sterling countries for the purposes of the regulations include British mandated territories, Egypt and the Sudan. The goods included in the schedules include the following:—Welded conduit pipes and tubes; close-jointed iron and steel pipes and tubes; electric heating and cooking appliances and elements; electric fans; electric household floor polishers, ironing machines and dish-washing machines; electric hair dryers; various telephone and telegraph equipment; electroliers; radio receivers and parts and radio-gramophones; storage batteries and parts; dry batteries and cells; sparking plugs; wall, stand and table lamps; electrical fittings and accessories; AC watt-hour meters (other than two-rate and three-element) combined or separate; telegraph and telephone cables, paper-insulated lead-covered, and certain other types of covered electric wire and cable; electric irons; and bowls, shades, reflectors and refractors, for lighting purposes, of glass other than cut glass.

Fuel Rationing Suspended

The Mines Department last week issued an announcement suspending the operation of the Fuel and Lighting Order. It stated that since the ration for coal, gas and electricity was raised to 100 per cent. of last year's consumption, it has been found that substantial economy is being practised by the public; and the Government has decided, therefore, that in present conditions it is not necessary for the statutory restriction to be retained. The Government is relying on the public continuing to exercise the utmost economy, and it is of great importance that they should do so. In case there should be any appreciable fall in coal stocks or any other situation should arise which necessitates the reintroduction of rationing, either nationally or regionally, machinery for rationing must be ready to be put into operation at very short notice. For this reason it is necessary to retain the rule that consumers of coal may purchase only from the merchants with whom they are registered.

Classification of Copper

In the recently issued Control of Non-Ferrous Metals (No. 5) Order, 1939, a new and perhaps rather unfamiliar classification of commercial copper has been included, which is briefly as follows:—(1) High conductivity electrolytic copper; (2) Fire-refined copper sold or intended to be sold as high conductivity copper; (3) High grade fire-refined copper; (4) Fire-refined copper of ordinary quality containing not less than 99.7 per cent. of copper; (5) Fire-refined copper containing not less than 99.2 per cent. of copper; and (6) Black hot-rolled copper wire rods.

Although this classification will be criticised, the Copper Development Associaion considers it to be a praiseworthy attempt to place the grading of copper on a more logical and scientific basis; such obsolete and ill-defined terms as "Best Select," "Fine," "Tough," &c., are absent. On the other hand, the view may be taken that the new classification does not go far enough and is neither as complete nor as definite as it might be, but presumably it is a compromise based on many conflicting factors which have had to be taken into account to meet the present abnormal state of affairs and to interfere as little as possible with established commercial practice. If there is a shortage of any particular brand it should not be difficult to obtain suitable substitutes from sources within the Empire. Copper of grades (1) and (2) in the classification will conform to the recognised standards for high conductivity metal and these grades as well as grades (4), (5) and (6) do not call for any particular comment. In the case of grade (3), however, it will be noted that no details are given of what the term is intended to cover, but it is evident

that it is designed to include that large category of first quality fire-refined copper, much of which has in the past originated from Chilean and, more recently, African sources, of which such brands as C.F.R., Braden, M.T.D., B.C.R. and E.R.M. are examples. In nearly all cases the minimum copper content of this grade would be approximately the same as that of the high conductivity grades (*i.e.*, about 99.88 per cent.) although, of course, the metal might not always be suitable for electrical purposes requiring the highest conductivity.

While the new classification is based primarily on conductivity and copper content, and indirectly on impurities, provision has been made to include also certain categories of copper containing very small amounts of specified constituents such as arsenic, cadmium, &c. For the purpose of classification the specified constituents are to be counted as copper. Thus, for instance, arsenical copper containing over 99.3 per cent. copper and nominally 0.4 per cent. arsenic would be classed not as grade (5) but as either arsenical grade (3) or (4) according to its combined copper and arsenic content.

Although the new grading may not be ideal for adoption in all future circumstances without amplification or adjustment, it should be welcomed as the foundation upon which a better and more logical order of things in the copper industry can be established.

North-Western Council and Board

The annual conference of the North-Western employers in connection with the District Council and Board (Electricity Supply Industry) took place at Manchester recently. It is twenty-one years since the first conference took place and this was the first occasion upon which Sir Thomas Higham (Accrington) was unable to be present, owing to indisposition. Alderman Walker was elected to the chair, and he reviewed the work of the organisation during the past year. The conference was very well attended, particularly having regard to travelling difficulties.

The conference approved the amendment of the constitution for the employers' side providing for a revision of grouping and an increase of membership from 12 to 15 members. Instructions were given for a message to be sent to Sir Thomas Higham expressing regret at his indisposition.

Later a further conference took place to review the work of the new organisation in connection with the District Joint Committee of Local Authorities and Chief Engineers. After a temporary cessation of activities due to the war this Committee is again resuming consideration of its problems, and the conference re-elected the retiring representatives.

Registered Electrical Contractors

At the last meeting of the Executive Committee of the National Register of Electrical Installation Contractors the following applications for registration were accepted :—G. Todd, 16, Charlesworth Terrace, Clitheroe; E. Good (trading as Good's), 23, Newborough, Scarborough; Langton & Young, Ltd., 92, High Street, Rainham, Kent; A. H. Cornwall & Sons, Ltd., 5, Victoria Street, London, S.W.1.

At the same meeting two aplications for registration were declined.

Whitaker's Almanack

The 1940 edition of Whitaker's Almanack (J. Whitaker & Sons, Ltd., 12, Warwick Lane, London, E.C.4), is of particular interest, as in addition to containing the usual information on almost every conceivable subject, it chronicles the approach to war, the event following the invasion of Poland, and the consequent outbreak of hostilities. All the matter has been brought up to date (the new Government of Finland is included, as well as details and personnel of the new Government Departments in this country), and in addition the Almanack records for the first time in permanent form, details of the emergency legislation which affects any type of business and every household. It is published in three editions, the library edition in leather binding with coloured maps at 12s. 6d. net, the complete edition, red and green cloth cover, 7s. net, and the abridged edition, orange paper cover, 3s. 6d. net.

Cables Motors for Australia

A London firm of shipping agents informs us that certain of its customers in Australia desire to represent reliable makers of insulated cables for electrical installations, motor-car ignition, &c., and electric motors. We shall be pleased to pass on to the firm letters from any British concerns interested in the matter.

Engineers' Wages

The engineering trade unions will present their case for an increase of wages at a conference with employers on January 10th.

A Long-service Generator

A veteran Crompton DC generator over forty years old is still in use at a Chesterfield works. It is a bi-polar machine with wrought-iron magnets and its output is 75 kW, 220 V at 560 RPM. The generator is used for twelve hours' every day and it is capable of carrying a 50 per cent. overload for many hours. In spite of its long life the original bearings and commutator are still in service. When the generator was installed it was arranged for belt drive. In about 1904 it was direct coupled to a vertical steam engine, and a few years later a further alteration was made, this time to a rope drive. Finally, in 1915, the plant was altered and the drive from a synchronous motor was taken to the generator through a gearbox. This interesting old generator is one of many of similar age made by Crompton & Co. (now Crompton Parkinson, Ltd.), which are still giving continuous trouble-free service in many parts of the world.

Industrial Welfare

The annual report of the Industrial Welfare Society which has just been issued describes how the organisation is helping and advising hundreds of firms on a variety of problems. It shows the steady progress being made and what industry is doing by providing well-constructed and healthy workshops, by the provision of canteens, club rooms, the development of works councils, the establishment of pension and benevolent funds, to make daily toil more congenial and the later years of life less insecure. The Society arose out of the last war, and with the present relaxation of many of the restrictions of the Factories Act, longer working hours, night shifts for women and juveniles, the hardships of travelling and the black-out, its work is more vital than ever. The Society was to have marked its 21st anniversary this autumn by some fitting celebration, and while this has had to be abandoned, the chairman, Sir Charles Craven, and the hon. treasurer, Mr. E. Leete, in view of the special needs brought into existence by the war, are launching an appeal for funds to enable the work of the Society to expand to meet the new demands.

L.E.P. War Comforts Fund

In order that parcels of cigarettes, knitted goods, and other acceptable gifts may be forwarded at intervals to members of the L.E.P. Co.'s staff serving with the Forces, a war comforts fund has been set up at the instance of Mr. C. D. Taite, chief engineer and manager. All departments of the company are represented on the committee that has been formed under the chairmanship of Mr. V. T. T. Atkinson, the assistant

Members of the staff of the Lancashire Electric Power Co. packing parcels for employees serving with the Forces

accountant, to operate the fund. Already an opportunity has been given to each man with the Forces to indicate what type of articles would be most acceptable, and our photograph shows the Christmas parcels being packed up ready for dispatch. Ladies' knitting parties have already produced a splendid range of socks, mittens, and the like.

Register of Safety Officers

It seems probable that a certain number of new appointments for safety officers will be created owing to wartime conditions. Existing safety officers' jobs may also fall vacant owing to their present holders being transferred to other work or to military service. In order to help those seeking such appointments, and firms who have vacant positions, the National "Safety First" Association is setting up a register of safety officers. Any safety officer or other person wishing to have his name put on the register should write to the Association at 52, Grosvenor Gardens, London, S.W.1, asking for a form. The applicant has a choice either of having his name forwarded immediately to any firm offering a job for which he appears to have suitable qualifications or of being informed of such jobs and asked whether he would like his name to go forward.

Australian Electrical News

With the coming of summer many seasonal electrical lines are selling freely, particularly as there is every indication of a rise in prices, states our Australian Correspondent. Electric refrigerators are greatly in demand, particularly in Sydney, where no initial deposit and five-year terms make purchase exceptionally easy. Vacuum cleaners are also selling well in all parts of the country, and portable air-conditioning plants now on the market look like becoming popular. Trade in general is on the quiet side, as is to be expected in such times as these, but with overseas sales of wheat, wool, meat and fruit assured it seems that Australia is likely to be in for some good times.

A special meeting of the Denmark (W.A.) and district Road

Board was held recently to discuss the purchase of further plant for the local power house. It was decided to buy an engine and generator at a cost of approximately £1,000, and arrangements are to be made to raise a loan of £2,000 for further purchases.

A Royal Commission is at present inquiring into the proposed establishment of a national power scheme at Collie to serve the south-west part of Western Australia. Members of the Commission, which is sitting at Parliament House, are Mr. F. E. Shaw (chairman), Mr. W. H. Taylor, general manager of the Government Electricity Supply Department, and Mr. F. C. Edmondson, general manager of the Perth City Council's Electricity and Gas Department. The beneficial effect which cheap electric power would have on the district was emphasised by many witnesses, although the managing director of the Collie Power Co. was of the opinion that a national power scheme was not a commercial proposition. At present the position in the south-west is that there is a multiplicity of small plants, which do not generally make for progress. The Commission has adjourned *sine die*.

Trade Announcement

Rd. Johnson, Clapham & Morris, Ltd., have opened a new city warehouse and showrooms at 7/9, Swan Street, Manchester, 4. The premises are more commodious than those occupied for many years at 24, Lever Street, Manchester. Owing to the outbreak of war they have had to alter their original plans for Swan Street, and the building is now equipped to provide the most effective service in war conditions.

Marine Engineering Scholarship

The General Committee of Lloyd's Register of Shipping offers a scholarship, valued at £100 per annum and tenable for three years, to be awarded on the results of the studentship examination of the Institute of Marine Engineers in May next year. The scholarship is intended to assist marine engineering students to take an advanced course of instruction in engineering subjects. The age limits are 18 to 23 years. The closing date for entries is April 8th, 1940. Further particulars, entrance forms, and copies of previous papers may be obtained on application to the secretary of the Institute of Marine Engineers, 73, Amersham Road, High Wycombe, Bucks. The entrance form for the scholarship is distinct from the entrance form for the studentship examination, and a candidate for the studentship examination who wishes also to compete for the scholarship must complete and return both forms by the dates specified.

The Knowles Electrolytic Cell

The International Electrolytic Plant Co., Ltd., has issued a further edition of "The Knowles Electrolytic Cell" pamphlet, in which is described in detail not only the well-established principles on which the cell is designed, but also the various improvements which have from time to time been made in these cells for the production of hydrogen and oxygen. The description of the modern plant is preceded by interesting historical notes relating to research for the production of pure oxygen.

Prices of Materials

Henry Gardner & Co., Ltd., report, December 27th: Copper bars (best selected) sheet and rod, no change. English pig lead, £26 10s. Spelter, no change. English block tin, £250 5s., £7 5s. decrease.

Edward Till & Co. report, December 27th: No change in the price of India-rubber, Para fine.

Restaurant Lighting

Concealed lighting, owing to its softness, is particularly suitable for such places as restaurants. An attractive example is to be seen at the new Rector's Club just opened at 207, Regent Street, London, W.1. Here the principal illumination comes from cornice fittings concealed in the centre portion of the ceiling, a three-colour system controlled by a Venreco dimmer permitting any desired colour effect to be obtained. To supplement this is a number of plaster wall brackets designed to harmonise with the general architectural scheme and these too give indirect lighting only. The electrical contractors were Requirements Electrical & Engineering, Ltd.

N.E. Coast Equipment Pool

At a meeting of the Tees-side Chamber of Commerce last week the secretary read a letter from Col. S. E. Monkhouse, managing director of the North-Eastern Electric Supply Co., stating that industrialists in the area must have a great deal of spare electrical plant and suggesting that this might be pooled for use in an emergency. Industrialists' organisations in the area are said to be in favour of the scheme.

Calendars and Diaries

The diary received from George Cohen Sons & Co., Ltd., has a neat navy-blue leatherette binding and contains a good deal of useful technical data. There are a number of pages at the back for notes.

The monthly slips of the calendar of British Jeffrey-Diamond, Ltd., are surmounted by an excellent picture of Walton Hall, near Wakefield, the home of the late Charles Waterton, the famous naturalist.

"Miss Mischief" is the appropriate title of the charming picture on silk of a young Victorian maiden which adorns the calendar of Milne & Longbottom.

The handy pocket diary sent us by Erskine, Heap Co., Ltd., is bound in black morocco leather and contains much information of interest to electrical engineers.

A reproduction of a rural scene by A. Vickers, Senr., makes an attractive picture for the calendar of C. Townsend Hook & Co., Ltd.

Landis & Gyr, Ltd., have sent us a refill for their desk calendar.

A well-executed etching of their offices at 3 and 4, Staple Inn, W.C.1, makes an effective picture for the calendar sent us by Lionel Robinson & Co., Ltd., which has monthly slips.

The neat pocket diary received from the Telegraph Construction and Maintenance Co., Ltd., is bound in dark red leatherette and contains much technical data.

Power Station Staffs' Salaries

The rise in the cost-of-living index figure during the last six months wil necessitate an adjustment of salaries under the National Joint Poard schedule as from January 1st. The existing salaries are based on 14 "points of adjustment" reduction of the basic figure; the new rates will be calculated on 12 points reduction.

Torch and Battery Prices

The first Order made by the President of the Board of Trade under the Prices of Goods Act, 1939, includes electric torches, batteries and bulbs.

Fire

A fire occurred on Wednesday last week at premises adjoining the Nottingham branch of the General Electric Co., Ltd. The G.E.C. building was not involved in the fire but considerable damage was caused by smoke and water. The company has taken premises at 33, Pilchergate, Nottingham, and business is being carried on as usual.

Lighting Contract Fraud Charge Fails

The three Bolton men accused of conspiracy to defraud the Bolton Corporation of large sums in connection with the delivery of street lamp frames, for which it was alleged the Corporation overpaid £522 were found not guilty at Manchester Assizes on December 5th and they were discharged. The accused men were William Robinson, master tinsmith, of Chorley Old Road, Bolton; Frederick Vose, works foreman, of Homer Street, Bolton, employed by Bolton Corporation; and Evan Cain, labourer, of Crook Street, Bolton, also employed by Bolton Corporation. Robinson and Vose denied the allegations, and in evidence Cain said that he did not conspire with the other two men or anyone else to defraud the Corporation. The judge said that the jury might think that the inquiry had disclosed a remarkable state of affairs, but they were not sitting as a committee of inquiry into the Bolton Corporation Street Lighting Department; they were sitting as members of the jury of a court which was administering criminal law.

New Catalogues and Lists

R.N. Electrical Repairs, Ltd., Winder House, Paradise Road, London, S.W.4.—A folder describing the company's repair service for industrial and domestic motor and electrical tools.

Aabacas Engineering Co., Ltd., Birkenhead.—A folder demonstrating the economies effected by the use of the company's cranes, hoists, conveyors, lifts, stackers, and runways.

Rotherham & Sons, Ltd., Spon Street, Coventry.—A leaflet drawing attention to the 90 years' history of the company as pioneers of precision manufacturing.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, London, E.C.4.—List No. 1,100 illustrating and describing a new shop window lighting box fitting conforming with Home Office requirements.

V. & E. Friedland, Ltd., 156-8, Fairfax Road, Harringay, London, N.8.—Leaflets describing 6-V shop signs.

Tucker & Edgar, Berkeley Works, Berkeley Road, London, N.W.1.—An illustrated leaflet giving details of "Teeanee" A.R.P. screened lighting units.

Belling & Co., Ltd., Bridge Works, Southbury Road, Enfield.—A sheet drawing attention to three products that are likely to prove very popular as presents—a bed warmer, the "Champion" general purpose heater and the "Dandie" fire.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

NEW EMPIRE battery.
UNION bench drill.

ELECTRICITY SUPPLY

Improved Sales at Burton-on-Trent. Proposed Joint Department at Lytham St. Annes. Large New American Power Station Planned

Bedford.—LIGHTING IN A.R.P. SHELTERS.—The Emergency Committee has decided to install electric lighting in air raid shelters at a cost of £462.

Boston.—INCREASED CHARGES.—The Boston & District Electric Supply Co., Ltd., announces an increase in the "all-in" and "two-part" tariff running charge from ¾d. to 1d., and in the water-heating tariff from ⅝d. to ¾d. per kWh after the March quarter meter readings.

Brighton.—COUNCIL AND SOUTHWICK EXTENSION SCHEME.—When a proposal to spend £185,000 on part of the extension scheme laid down for the Southwick power station recently came before the Town Council, it was decided to inform the Electricity Commissioners that the Council was not fully aware of the special need for the plant at the present time. It therefore was unable to satisfy itself that the expenditure could not be avoided or reduced in accordance with the terms of the Treasury circular of November 24th.

Burton-on-Trent.—ELECTRICAL ADVANCE.—The borough electrical engineer informed the Town Council at its December meeting that the sales of electricity in October showed an increase of 13.4 per cent. over the corresponding month of last year. On the other hand, the report of the gas engineer (for the six weeks ended November 16th) revealed a decrease in output of 14.1 per cent.

SUPPLY EXTENSIONS.—The Electricity Committee has decided to extend the mains to Hoar Cross, at a cost of £503, and to Several Wood Farm, Smisby (£149).

Calne.—LOAN APPLICATIONS.—The Electricity Committee has applied for loans of £1,000 for meters and £500 for consumers' wiring installations.

Chesterfield.—LIGHTING TRENCHES.—Application is being made by the Town Council for permission to borrow £2,494 for the installation of electric lighting, &c., in school trenches.

Darlington.—AIR-RAID SHELTER LIGHTING.—The Town Council is to provide a low-voltage system of lighting in air raid shelters at a cost of £161.

Dartford.—PRICE INCREASE.—A decision to increase the price of electricity under tariffs not subject to a coal clause was made at a recent meeting of the Town Council. The new charges, which take effect as from the end of the year, are as follows:—Business and domestic lighting, 5¾d. per kWh; cooking, water heating, &c., 1d.; domestic "all-in" tariff, 1d. (prepayment) and ¾d. (quarterly); domestic small power, heating, photographic lighting, medical light ray and accumulator charging, 1½d.; outside shop lighting, 2¼d.; church lighting, 4½d.; public lighting, 1¼d.; A.R.P. sector posts (light and heat), 1½d.

Dewsbury.—DEARER ELECTRICITY.—The Council announces that as from the meter readings for the December quarter the charges for electricity will be advanced as follows:—Ordinary meter consumers: All kWh charges (including the "unit" charge on rateable value system), by 10 per cent.; rateable value percentage charge from 15 per cent. to 16½ per cent.; prepayment meter consumers, an increase of ½d. per kWh for lighting and 10 per cent. for consumption other than lighting.

Farnborough (Hants).—ELECTRIC PUMPING PLANT.—At a recent meeting of the Urban District Council it was reported that the consumption of electricity at the Southwood Road and Minley Road pumping stations had risen to nearly three times the normal amount, and also that it might be necessary in the near future to increase the size of the Cove Bridge station.

Hamilton.—BULK SUPPLY CHARGE BASIS.—It was recently reported to the Council that in future the terms chargeable by the Clyde Valley Electrical Power Co. for a bulk supply to the burgh would be the amount which the company paid to the Central Electricity Board, with a small addition in respect of the use of transmission lines. This had been the contention of the burgh electrical engineer (Mr. W. J. Cooper) in his negotiations, whereas the company had taken the view that it was entitled to negotiate terms. The pronouncement by the C.E.B. would mean a considerable saving to the burgh, and credit was due to the electrical engineer and the convener.

High Wycombe.—PURCHASE OF UNDERTAKING.—At a recent meeting of the Town Council it was resolved to make application to the Electricity Commissioners for permission to borrow a provisional sum of £200,000 for the purchase of the undertaking of the Wycombe (Borough) Electric Light & Power Co., Ltd.

Irthlingborough.—STREET LIGHTING.—The Urban District Council has agreed to bear half the cost of £114 per annum incurred by the Rushden & District Electric Supply Co., Ltd., for maintaining the public street lighting system while the emergency continues, and to extend the company's contract by a period equivalent to that during which the street lamps remain unlighted.

Leicester.—INDUSTRIAL LIGHTING CONCESSION FORESHADOWED.—Speaking at a recent meeting of the Chamber of Commerce Councillor Worthington said that he had been in negotiation with the chairman of the City Electricity Committee on behalf of membrs who were finding the burden of operating throughout the day by artificial light very great. One engineering firm, by no means the largest in Leicester, had just received a bill for electric light charges during the past three months of over £600. Within the next two or three weeks a new tariff to meet these special conditions would be issued.

London.—HAMPSTEAD.—As from the December meter readings electricity charges are being increased as follows:—Lighting flat rate, from 3d. to 4d. per kWh; power from ¾d. to 1d. per kWh; and the two-part tariff running charge from ½d. to ¾d. per kWh.

BATTERSEA.—A net surplus of £17,813 for the year ended March 31st last is reported by the Electricity Committee.

POPLAR.—The Electricity Committee recommends a 10 per cent. increase in charges.

Lossiemouth.—PLANT OVERLOADED.—Mr. R. A. Traill, electrical engineer to the Council, reports that the black-out has led to an exceptional demand which has been met by overloading the plant and utilising the storage battery. This state of affairs has caused considerable anxiety as the plant has been fully loaded every day. He states, however, that the Grampian Co. will almost certainly be able to give a temporary supply.

Lytham St. Annes.—JOINT ADMINISTRATION OF UNDERTAKINGS.—A special committee of the Council is considering the desirability of amalgamating the gas and electricity undertakings as a Light and Power Department.

Middlesbrough.—HOSPITAL INSTALLATION.—Consideration is being given by the Town Council to the installation of electric lighting at the Hemlington Hospital.

SUPPLY TO WARDENS' POSTS.—The Town Council has adopted a proposal by the borough electrical engineer that the charge for electricity for lighting and heating wardens' posts shall be 30s. per annum plus ¾d. per kWh, subject to a coal clause.

Middleton.—PROPOSED SUB-STATION.—The Town Council is to erect a sub-station at Alkrington.

Spenborough.—RETENTION OF UNDERTAKING.—Having considered a letter from the Electrical Distribution of Yorkshire, Ltd., the Council has decided to inform the company that it is not prepared to entertain the transfer of the electricity undertaking to the company.

Swansea.—TARIFF INCREASES.—Recommendations of the chief engineer and manager (Mr. H. E. Blackiston) for increased charges for electricity in the borough have been approved by the Electricity Committee. The lighting flat rate is to be raised from 4¾d. to 5¼d. per kWh, with an advance to prepayment consumers from 5¼d. to 6¼d. per kWh. The maximum demand tariffs, secondary rate, will be increased from 2d. to 3d., and minor adjustments will be made in the charges for churches, cinemas, shops (special contracts). The flat rate for domestic heating is to be abolished. The increases are to come into operation as from the December meter readings and are to be reviewed at the end of the financial year.

(Continued on next page.)

Electricity in Portugal

IN the use of electricity Portugal is a long way behind the leading countries, but some progress is being made. Last year the total output of electricity in the country amounted to 425.7 million kWh, and over the total population of 6,360,000 this averages 67 kWh per head. In the previous year production amounted to 406.1 million kWh, so that last year there was an improvement of 5 per cent. The number of consumers increased by 17,000 to 320,600.

The 1938 report of Signor Ferreira Dias, chief engineer of the Portuguese National Electrification Council, shows that at the end of the year there were 654 generating stations in commission, with an installed capacity of 280,000 kW, an increase of 17 stations and 12,600 kW compared with the previous year. The number of stations engaged in providing a supply to the public and for traction is given as 176 (213,000 kW); only ten had a capacity exceeding 5,000 kW and these aggregated 165,000 kW. Of the total generating plant in the country at the end of the year 28 per cent. was hydro-electric.

The principal consuming industries with their 1938 totals were as follows: textile, 78.9 million kW; pottery and building, 35.3 million kWh; food preparation, 23.9 million kWh; chemical, 16.8 million kWh; mining, 14.2 million kWh; metallurgical and mechanical engineering, 9 million kWh; water-pumping plant, 10.8 million kWh; and paper manufacturing, 8 million kWh.

There were approximately 3,171 miles of high-voltage lines in Portugal at the end of 1938; of this total all but 325 miles were overhead. Most of the high-voltage overhead lines were operated at up to 25 kV, with 261 miles at over 50 kV.

Tynemouth.—HIGH-VOLTAGE CABLE.—The Town Council is considering laying a high-voltage cable to a new sub-station at the Albert Edward Dock for the Tyne Improvement Commission.

Walsall.—A.R.P. CONTROL ROOM.—At a cost of £770 the Electric Supply Committee is to erect a departmental A.R.P. control room.

Walton and Weybridge.—NO PRICE INCREASE AT PRESENT.—At a recent meeting of the Urban District Council it was stated that the Electricity Committee did not consider it necessary to make any revision of tariffs before the end of the present financial year.

Whitehaven.—TARIFF INCREASES.—The Town Council has decided to increase lighting charges by ¼d. per kWh; the two-part tariff "unit" charge by ¼d.; cooking and heating by ¼d.; and low-voltage power by 5 per cent.

Overseas

Belgian Congo.—WATER-POWER RESOURCES.—The reserves of hydro-electric power, which are likely to play an important part in the development of the Congo, were referred to in a recent lecture by Colonial Minister De Vleeschauwer at Liège, Belgium. He said that the production of cotton seeds had jumped from 46,400 tons in 1933 to 120,000 tons in 1938. The man-power ginning mills of the first years had been succeeded by 120 up-to-date power-driven mills. Detailing the various power schemes, he said that the Sogefor company, which supplied annually 200 million kWh, had harnessed the 340-ft. falls of the Lufira at Mwadingusha.

Canada.—ST. LAWRENCE PROJECT.—Negotiations are now in progress between the Ontario Government and the Government at Ottawa with respect to an agreement concerning the construction of the St. Lawrence waterway and power project. According to the *Electrical World*, it is expected that the agreement will be signed in the near future. Support for the project has taken on new interest in Washington, where efforts are being made to bring the subject before Congress next year. The St. Lawrence project will constitute one end of the gigantic power interconnection system which Washington power proponents now have under consideration.

POWER SCHEME POSTPONED.—Owing to the outbreak of war the British Columbia Electric Railway Co. has postponed its plan to proceed with the erection of a new auxiliary steam plant at Brentwood Bay, near Victoria, B.C. The project was estimated to cost about $1,000,000.

France.—TRANSMISSION SCHEME.—A decree of the Ministry of Public Works has approved the construction of a high-voltage line between Damery (Marne) and Beautor (Aisne). Construction is to be designed for 150 kV, three-phase 50 cycles, the line comprising three steel-cored aluminium conductors of at least 210 sq. mm. cross section plus a steel earth cable of 60 sq. mm. It is calculated that the line will be able to carry up to 40,000 kW at 150 kV between phases, with a line loss of 15 kW per kilometre. Construction of the line has a double purpose. In the first place it will provide an important link between the high-voltage networks in the north of France, through Beautor, and the network of the Société de Transport d'Energie de l'Ile de France which, in the region of Paris, has already connections to most of the other parts of the French grid. It will, moreover, permit easier service of light and power requirements to the region which the line traverses. Another decree authorises the construction of a line between Saint Lo and Cherbourg. It is to be built for 60 kV, but will, for the present, be operated at 30 kV. It will comprise two three-phase, 50-cycle circuits, each of three bare copper conductors of at least 53 sq. mm. cross section. Operation of the proposed line will be until the power transmitted amounts to at least 2,500 kW per circuit. When this figure is reached a step-down sub-staton will be built at Cherbourg and the line voltage will be raised to 60 kV, which will increase the load capacity of the line. Construction of this line will connect the distribution system of Cherbourg to the general French grid through Caen.

India.—SURVEY OF RESOURCES IN BENGAL.—An interim report was recently submitted by Mr. S. A. Radolift, officer on special duty, electrical inquiry, Bengal, to the Industrial Survey Committee appointed by the Government of Bengal. After considering the report the Committee is understood to have recommended that a survey should be made of the waterfalls and coal resources of the province. On the basis of such a survey it is believed that it would be possible to construct power stations in different parts of Bengal for a province-wide supply of electricity.

Malaya.—SMALL POWER PLANTS.—To serve small townships and villages in Perak the Kinta Electrical Distribution Co. has completed nine generating stations with capacities of from 5 to 25 kW. Development of the scheme has been carried out in a period of approximately twelve months and has entailed an expenditure of $150,000. To enable charges to be as low as possible the service is restricted to times when the majority of consumers require a supply.

Rhodesia.—NEW POWER STATION.—It is reported in *East Africa & Rhodesia* that the Shabani Power Station has been recently brought into operation in Southern Rhodesia, this being the tenth station to be opened in the colony by the Electricity Supply Commission.

Russia.—HEAT DISTRIBUTION SYSTEMS.—In the centralised supply of heat for municipal, industrial and domestic purposes it is claimed that Moscow takes first place in Europe and second place in the world, after New York. In 1938, the Moscow thermo-electric stations supplied more than 1½ million megacalories of heat. At the beginning of 1939 the capacity of such stations in Moscow was about 175,000 kW and the length of pipes in the system was more than 37 miles. Four new stations are now being built in Moscow. While strengthening the power resources of the Soviet Union, the thermo-electric stations considerably reduce the consumption of fuel.

Sweden.—POWER FROM THE INDALSALVEN RIVER.—A great deal of the power supply of Sweden is derived from the Indalsälven River, through the Krängede, Hissmoforsen and Hammarforsen hydro-electric stations. Early this year the capacity of the Krängede station was brought up to 105,000 kVA by the installation of the third of the six generators for which it was planned, and the station thus became the third water-power plant in Sweden to exceed 100,000 kVA (the others are at Porjus and Tröllhattan). Both Chambers of the Riksdag have now agreed to a proposed loan of 3,000,000 kr. to enable the company owning the Hissmoforsen station to extend the plant by the installation of two more sets.

The first generator has recently been commissioned at the new Stadsforsen station, also on the Indalsälven River. The 40,000-kW set is the largest so far used at any Swedish power station, according to a *Reuter* message. Another set of the same size is expected to be completed next spring. The output of the station is being transmitted to Central Sweden at 220 kV.

The next scheme for exploiting the resources of the river concerns the Kattstrupeforsen Rapids, where it is proposed to build a station with, at first, three sets which would be completed in 2½ years and have a capacity of 36,000 kW. The estimated cost is 12,500,000 kr. and a State loan is being sought.

United States.—NEW 500,000-kW STATION PLANNED.—According to the *Electrical World* the Philadelphia Electric Co. plans the construction of a new thermal generating plant which will have an ultimate capacity of 500,000 kW and cost $45,000,000. The station will be built in South Philadelphia on the Delaware River. The company has purchased the $3,000,000 plant of the Pennsylvania Salt Manufacturing Co. as the site of the new station. It is expected that preliminary work on the plant will be started in 1941.

Japanese Water-power Scheme

From a Tokyo Correspondent

A DAM of large dimensions has been completed for the Kawabe power plant of the Toho Electric Power Co. It traverses the lower stream of the Hida River, a tributary of the Kiso. The effective head is 24.33 metres, and a maximum of 26,500 kW is developed. The dam has a total spread at the top of 178 metres and a height of 35 metres from bedrock.

The sluice gates of the dam consist of 12 roller gates, each having a clear span of 11.8 metres and a height of 8 metres. One gate is made to sustain a water pressure of 410 tons, and is supported by eight rollers, two of which are recessed in one rocker beam, making each roller sustain an equal pressure. Special attention has been paid to the construction of the gates, so as to make them immune to any deflection of the materials used by changes in climate and temperature, as well as water pressure.

A hoist with a 25-HP motor capable of lifting the gates of the dam at a speed of 0.35 metres per minute is installed midlength of the bridge. Lifting or lowering of the gates is performed by steel wire ropes. Three roller gates, each having a clear span of 9 metres and a height of 8 metres, constitute the sluice gates for the water tank, which is set up to the right of the dam; penstocks from this guide the impounded water to three water turbines of the Kawabe power plant for the ultimate generation of 26,500 kW. For these gates there is a hoist with a 35-HP motor capable of lifting the gates at a speed of 1.8 metres per minute. While the commencement of lifting or lowering by the hoist is effected by a push-button switch, stopping or starting in the course of lifting is controlled by a float switch which automatically operates as the level of water rises or recedes. This device was specially provided for preventing a sudden flow of water which might damage the power plant.

All the gates may be operated by direct control from the side of the motor on the bridge or by remote control from the watch tower. In either case, gate-opening indicators automatically show the extent of opening. In the watch tower is a high-speed Diesel engine directly connected to a three-phase, AC generator, and other electrical apparatus available in case of emergency. The eight-cylinder Diesel engine develops 250 HP at 1,200 RPM.

NEW PATENTS

Electrical Specifications Recently Published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1938

5072. "Gas or vapour filled electric-discharge tubes." N. S. Oerensofi. February 18th, 1938. (515197.)

6212. "Method of operating electron multipliers." Farnsworth Television, Inc. March 22nd, 1937. (515297.)

6488. "Discharge lamps employing luminescent material." F. B. Dehn (Heatless Light Corpn.). March 1st, 1938. (515298.)

6890. "Echo-sounding apparatus." Marconi's Wireless Telegraph Co., Ltd., and H. Galway. March 4th, 1938. (515199.)

8149. "Echo-sounding installations." H. Hughes & Son, D. O. Sproule and A. J. Hughes. March 16th, 1938. (515200.)

8150. "Dynamo-electric machinery." H. Hughes & Son, D. O. Sproule and A. J. Hughes. March 16th, 1938. (515201.)

8524. "Echo-sounding recorders." Marconi's Wireless Telegraph Co., Ltd., and N. P. Hinton. March 19th, 1938. (515202.)

9557. "Photo-electric devices." H. G. Lubszynski and L. Klatzow. March 29th, 1938. (515301.)

9605. "Electric-discharge device working with a gap of ionised gas, and a method for the operation of devices of this kind." D. Halasz and B. Karlovitz. March 29th, 1938. (515203.)

9780. "Signal - amplifying systems." A. D. Blumlein. March 30th, 1938. (515348.)

12119. "Television and like systems." Pye, Ltd., W. Jones and B. J. Edwards. April 22nd, 1938. (515302.)

12236. "Electric cables." C. J. Beaver, E. L. Davey, and W. T. Glover & Co., Ltd. April 23rd, 1938. (515206.)

12355. "Electric motor control systems." British Thomson-Houston Co., Ltd., and K. M. Fox. April 25th, 1938. (515303.)

12482. "Electric-lighting fittings." General Electric Co., Ltd., A. J. Burbridge and L. E. A. Phillips. April 26th, 1938. (515147.)

12858. "Television receivers. Scophony, Ltd., and F. Okolicsanyi. April 29th, 1938. (515304.)

14572/14573. "Coupling devices for high-frequency electric circuits." Johnson Laboratories, Inc. June 3rd, 1937. (515194/515305.)

14629. "Elimination of undesired electrical signals." E. L. C. White. May 17th, 1938. (505208.)

14776. "Television systems." Electric & Musical Industries, Ltd., and E. L. C. White, May 18th, 1938. (Addition to 476935.) (515209.)

14917. "Circuit arrangements for separating electric pulses." E. L. C. White. May 19th, 1938. (Addition to 491728.) (515210.)

14985. "Mountings for electric lamps." British Thomson-Houston Co., Ltd. May 19th, 1937. (515211.)

15486. "Electric protective arrangements, more particularly for luminous electric-discharge tube systems." Claude-General Neon Lights, Ltd., and C. Higgins. May 24th, 1938. (515216.)

15537. "Apparatus for the metallising of objects in vacuo by metal vaporising or cathode sputtering." R. Bosch Ges. May 29th, 1937. (514148.)

15543. "Magnetic electron lenses." H. Miller and H. E. Kallmann. May 25th, 1938. (Cognate application 17360/38.) (515308.)

15590. "Apparatus for applying X-rays or rays of like nature." F. W. B. Hambling. May 25th, 1938. (515218.)

15593. "Controllers for electric motors." Allen West & Co., Ltd., and C. Johnson. May 25th, 1938. (515150.)

15594. "Pneumatically or hydraulically operated electric contactors." Allen West & Co., Ltd., C. Johnson and W. J. Paddock. May 25th, 1938. (515151.)

15616. "Electric-discharge lamps." General Electric Co., Ltd., and H. G. Jenkins. May 25th, 1938. (515154.)

15630. "Multi-position electric switches particularly for controlling electric motors." British Thompson-Houston Co., Ltd., and W. L. Wise. May 25th, 1938. (515220.)

15651. "Thermionic valve amplifiers." A. R. A. Rendall. May 25th, 1938. (515158.)

15656. "Apparatus for measuring noise." R. W. Guelke and Metropolitan-Vickers Electrical Co., Ltd. May 25th, 1938. (515160.)

15688. "Electric socket couplings combined with switches." J. A. Crabtree & Co., Ltd., H. F. McLoughlin and B. G. Harrison. May 26th, 1938. (515165.)

15716. "Magnetic gauge." C. F. Lumb. May 26th, 1938. (515221.)

15755. "Electric circuit arrangements for operating electric-discharge devices." Claude-General Neon Lights, Ltd., and G. T. Kingsley-Lark. May 26th, 1938. (515174.)

15756. "Mercury arc convertors." General Electric Co., Ltd., and H. T. Ramsay. May 26th, 1938. (515175.)

15769. "Prepayment mechanism for meters and the like." Switchgear and Meters, Ltd., and A. W. Angold. May 26th, 1938. (Cognate application 2461/39.) (515223.)

15781. "Thermally operated electric switches." C. A. Turner and Diamond H. Switches, Ltd. May 26th, 1938. (Cognate application 17955/38.) (515178.)

15790. "Key-switching devices suitable for use in telephone systems." J. E. Pollak (Associated Telephone and Telegraph Co.). May 26th, 1938. (515180.)

15820. "Electro-deposition of zinc." E. I. Du Pont de Nemours and Co., L. R. Westbrook and R. O. Hull. May 26th, 1938. (Addition to 499791.) (515186.)

15834. "Dynamo-electric lighting systems." Raleigh Co., Ltd., and W. Brown. May 27, 1938. (515224.)

15847. "Apparatus for indicating whether or not a potential difference exists between two conductors." A. Reyrolle and Co., Ltd., J. A. Harle, H. Leyburn and M. Waters. May 27th, 1938. (515261.)

15876. "Electron multipliers." H. G. Lubszynski. May 27th, 1938. (515264.)

15880. "Electric condensers." Siemens and Halske Akt.-Ges. May 27th, 1937. (515189.)

15891. "Electric battery charging systems." British Thomson-Houston Co., Ltd., and L. C. Ludbrook. May 27th, 1938. (515266.)

15894. "Electron emitters for discharge tubes." Marconi's Wireless Telegraph Co., Ltd. May 27th, 1937. (515190.)

15915. "Electric furnaces." Electric Resistance Furnace Co., Ltd. July 21, 1937. (515227.)

15931. "Electron-discharge devices of the retarding field type." Standard Telephones and Cables, Ltd. May 29th, 1937. (Cognate application 15932/38.) (515229.)

15935. "Circuit arrangements and thermionic valves for amplifying electrical oscillations." Standard Telephones and Cables, Ltd., D. H. Black and A. H. Roche. May 27th, 1938. (515271.)

15980. "Clamps for suspending and firmly anchoring overhead wires for electric railways and tramways." M. Baffico and G. F. Siccardi. May 28th, 1937. (515277.)

16008. "Conductors for electric apparatus." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 31st, 1937. (515354.)

16080. "Television or other signal transmission systems." A. D. Blumlein. May 30th, 1938. (515360.)

16082. "Transmission of electrical signals having a direct-current component." A. D. Blumlein, F. Blythen, and J. Hardwick. May 30th, 1938. (515362.)

16083. "Thermionic valve circuits." J. Hardwick. May 30th, 1938. (515363.)

16084. "Transmission of electrical signals." A. D. Blumlein. May 30th, 1938. (515364.)

16087. "Accessory apparatus for electric cable systems." Siemens Bros. & Co., Ltd., H. G. Wood, J. H. Broome and A. A. Neale. May 30th, 1938. (515366.)

16114. "Manufacture of valves having oxide-coated thermionic cathodes." M-O Valve Co., Ltd., and M. Benjamin. May 30th, 1938. (515371.)

16153. "Microphone apparatus." Marconi's Wireless Telegraph Co., Ltd. May 29th, 1937. (515377.)

16160. "Liquid compasses." Siemens Apparate und Maschinen Ges. May 29th, 1937. (Cognate application 16161/38.) (515324.)

16175. "Starting units for internal-combustion engines." R. Bosch Ges. May 31st, 1937. (515379.)

16238. "Electrolytic condensers." Siemens & Halske Akt.-Ges. May 31st, 1937. (515380.)

16244. "Multi-unit electric condensers." Standard Telephones & Cables, Ltd., and J. A. Leno. May 31st, 1938. (515382.)

16245. "Multi-range indicating devices for radio receivers." Kolster-Brandes, Ltd., K. G. Smith and P. A. Tiller. May 31st, 1938. (515383.)

17529. "Control systems for electrically operated elevators." British Thomson-Houston Co., Ltd. June 12th, 1937. (515234.)

17771. "Electric remote-control apparatus combined with apparatus for transmitting indications or movements to a distance." Elliott Bros. (London), Ltd., and C. F. Pizzey. June 15th, 1938. (515285.)

17807. "Electric-discharge devices." M-O Valve Co., Ltd., C. W. Cosgrove and E. C. R. Gant. June 15th, 1938. (515288.)

17995. "Electric control apparatus for tuning radio receivers." E. K. Cole, Ltd., and A. W. Martin. June 17th, 1938. (515292.)

18071. "Rheostatic braking of electric motors." A. Mandl and Metropolitan-Vickers Electrical Co., Ltd. June 17th, 1938. (515329.)

18113. "Electric plug-and-socket couplings." G. Subkis. June 18th, 1938. (515330.)

18360. "Electric furnaces." Metalectric Furnaces, Ltd., and C. G. McKeown. June 21st, 1938. (515339.)

18384. "Automobile headlight-testers." A. F. Burgess (Weaves Mfg. Co.). June 21st, 1938. (515340.)

18449. "Protective systems for polyphase electric circuits." British Thomson-Houston Co., Ltd., and S. N. Bourne. June 21st, 1938. (515341.)

21454. "Prepayment mechanism for electricity meters and the like." Switchgear & Meters, Ltd., and A. W. Angold. July 19th, 1938. (Cognate application 20753/39.) (515240.)

21509. "Radio communication systems." M. G. Fernandez and E. O. Figueroa. July 20th, 1938. (515241.)

1939

19565. "Electron-discharge devices." Standard Telephones & Cables, Ltd. May 29th, 1938. (Divided out of 515229.) (515395.)

20752. "Prepayment mechanism for electricity meters and the like." Switchgear & Meters, Ltd., and A. W. Angold. July 19th, 1938. (Divided out of 515240.) (515245.)

FINANCIAL SECTION

New Companies. Returns of Capital. Debenture Charges. Bankruptcies and Liquidations. Reports of Electrical Companies. Dividend Announcements. Stocks and Shares

New Companies Registered

J. H. Oberman & Sons, Ltd.—Private company. Registered December 22nd. Capital, £2,000. Objects: To acquire the business of an electrical and mechanical engineer and contractor carried on by J. H. Oberman at 16, High Street, Higham Ferrers, Northants, as J. H. Oberman & Sons. The directors are: J. H. Oberman (permanent governing director) and Mrs. E. S. Oberman, both of 16, High Street, Higham Ferrers; and J. E. Oberman and T. C. Oberman, addresses not stated.

George Forrest & Son, Ltd.—Private company. Registered December 16th. Capital, £100. Objects: To carry on the business of electrical engineers, lighting and power contractors, brass finishers, brass and iron founders, &c. The subscribers are: P. H. Harris, 32, Colombo Road, Ilford; and A. F. Brockwey, 62, Howard Road, Walthamstow, E.17. Secretary: V. A. Wexham. Registered office: 31/33, St. Bride Street, E.C.4.

Companies' Returns

Statements of Capital

Electric Driers, Ltd.—Capital, £2,000 in £1 shares. Return dated October 12th. All shares taken up. £1,950 paid. £50 considered as paid. Mortgages and charges, nil.

Bambairtite Battery Co., Ltd.—Capital, £2,000 in £1 shares Return dated November 2nd. 1,146 shares taken up. £146 paid. £1,000 considered as paid. Mortgages and charges, nil.

Simplex Electric Switchgear, Ltd.—Capital, £100 in £1 shares. Return dated November 2nd. All shares taken up. £100 paid. Mortgages and charges, nil.

Stella Conduit Co., Ltd.—Capital, £20,000 in £1 shares. Return dated November 2nd. All shares taken up. £20,000 considered as paid. Mortgages and charges, nil.

Wilkinson Bentley & Co., Ltd.—Capital, £3,000 in £1 shares. Return dated October 31st. 1,850 shares taken up. £1,850 paid. Mortgages and charges, nil.

Wm. Clarke Electrical Contractors, Ltd.—Capital, £1,500 in £1 shares. Return dated November 6th, 1939. All shares taken up. £750 paid. £750 considered as paid. Mortgages and charges, nil.

Microfuses, Ltd.—Capital, £100 in £1 shares. Return dated November 10th, 1939. All shares taken up. £100 paid. Mortgages and charges, nil.

Glynceiriog Electricity Supply Co., Ltd.—Capital, £1,500 in £1 shares. Return dated November 11th, 1939. 1,000 shares taken up. £1,000 considered as paid. Mortgages and charges, nil.

Stearn Electric Co., Ltd.—Capital, £4,000 in £1 shares. Return dated November 14th, 1939. All shares taken up. £2 paid. £3.998 considered as paid. Mortgages and charges, £18,200.

Ricardo & Co., Engineers (1927), Ltd.—Capital, £21,000 in 20,000 preference shares of £1 and 20,000 founders' shares of 1s. Return dated November 20th, 1939. All shares taken up. £2 paid on two preference shares. £20.998 considered as paid on the remainder. Mortgages and charges, nil.

Mortgages and Charges

Reeves & Co. (Birmingham), Ltd.—Mortgage and charge on leasehold property known as The Crescent Works. The Crescent, Birmingham, with plant and machinery, and the company's undertaking and property, present and future, including uncalled capital, dated December 7th, 1939. to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Cray Electrical Motors, Ltd. (formerly Invicta Vacuum Cleaners, Ltd.).—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 5th, 1939, to secure £1,550. Holder: F. Taussig, 13, Farringdon Avenue, E.C.

Satisfaction in full on December 1st, 1939, of debentures dated December 14th, 1935, October 24th, 1936, and August 14th, 1938, and registered December 23rd, 1935, November 2nd, 1936, and September 2nd, 1938, respectively. (According to the register of mortgages the mortgages registered December 23rd, 1935, November 2nd, 1936, and September 2nd, 1938, originally secured £550, £500 and £500 respectively.)

Fisher Humphries & Co., Ltd.—Charge on property at Holy Cross, Pershore, Worcs, dated September 28th, 1939, to secure £450 and any further advances. Holders: Cheltenham & Gloucester Building Society. (Registered December 12th, 1939, by permission of the Court.)

Kenyon Electrical Co., Ltd.—Debenture charged on the company's property, present and future, including uncalled capital, dated November 23rd, 1939, to secure £300. Holder: Leonard Chapman, 30, Union Street, Ardwick, Manchester, 12.

Wall & Attwooll, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 13th, 1939, to secure all moneys due or to become due from the company to the Whitworth Electric Lamp Co., Ltd.

Company Liquidations

E. G. Kellond, Ltd.—Winding up voluntarily. Liquidator, Mr. E. Hopkins, 14, Aldred Road, West Hampstead, London. Particulars of claims to the liquidator by January 20th. This notice is purely formal. All creditors have been, or will be, paid in full.

Woodfyt Sales, Ltd.—Winding up voluntarily. Liquidator, Mr. W. G. Howell, 50-51, High Holborn, W.C.1.

West Witton Electric Supply Co., Ltd.—Meeting January 26th at 235, Manningham Lane, Bradford, to receive an account of the winding up by the liquidator, Mr. W. Lund.

Bankruptcy Proceedings

H. J. Bruchsaler (H. J. Brooklyn & Co.), electrical distributor, 143, Warwick Road, Olton, near Birmingham, and lately carrying on business at Daimler House, Paradise Street, Birmingham.—Receiving order made December 14th on a creditor's petition.

A. J. Davis, wireless dealer and electrician, 15, Bridge Street, Exeter.—Receiving order made December 11th on debtor's own petition.

D. B. Jones, electrical contractor, 1, Tireithin, Llwynhendy, Llanelly.—Public examination January 9th at the Guildhall, Carmarthen.

J. O. D. James (James & Whiting), electrician, 102, Chepstow Road, Newport.—Receiving order made December 13th on debtor's own petition.

S. Burgoyne, electrician, 1, Mill Lane, Ferrybridge Road, Pontefract.—This debtor's public examination was held recently at the Court House, Wood Street, Wakefield, and was closed. The statement of affairs showed a deficiency of £68.

T. W. Dennison (T. W. Dennison & Co.), electrical and radio engineer, 40, Thornton Road, Bradford.—Receiving order made December 16th on debtor's own petition.

J. F. B. Wallen (Auto Radio Co.), radio dealer, 41, Prince George Avenue, Enfield, lately trading at 191, Elgin Terrace, Maida Vale, London.—Application for discharge to be heard on January 16th at Carey Street, London, W.C.2.

B. Harris (Central Radio), wireless dealer, 96, Harwood Road, Fulham, lately trading at 144, Kingsland High Street, E.8.—Last day for receiving proofs for dividend January 5th. Trustee, Mr. H. H. Gaine, Carey Street, W.C.2, Official Receiver.

H. M. Wise (H. M. Wise & Sons), electrical engineer and radio dealer, Corvedale Road, Craven Arms, Salop.—Last day for receiving proofs for dividend January 5th. Trustee, Mr. F. E. Bendall, King Edward House, New Street, Birmingham.

Reports and Dividends

The British Vacuum Cleaner & Engineering Co., Ltd., held its annual meeting on December 20th when Mr. H. C. Booth (chairman and joint managing director), who presided, said that the year under review had been one of acute disturbance which had inevitably been reflected severely in the results of their trading. At their last annual meeting, when he announced the new issue, they had the satisfaction of knowing that they had passed through the Munich crisis and that the sales volume for the first three months of the financial year showed an increase. The course of events, however, was such that in the result their sales for the year showed a very heavy decline. The vacuum cleaner industry as a whole had suffered very severely, but their strong relative position in the market was unimpaired. Apart from the domestic appliance section, which had inevitably felt the full impact of the conditions already referred to, their installation section had shown an appreciable increase.

In January last they acquired the business and goodwill of the Magneta Time Co., Ltd., an old-established company specialising in electrical time recording apparatus, the acquisition of which opened up avenues of exploitation of lines of manufacture for which the company was well equipped.

With regard to the future, having regard to war conditions, their business in the domestic field was likely to be severely restricted. They had been entrusted with a considerable volume of important contracts.

The Pernambuco Tramways and Power Co., Ltd., states that the sterling funds available up to November 30th will enable the payment of 5½ per cent. interest in sterling on the 5 per cent. first debentures.

R. A. Lister & Co., Ltd., report a profit for the year to September 30th of £219,417, as compared with £245,023 in the preceding year, the figures being struck after depreciation and contingencies. The final ordinary dividend is 5 per cent., plus a bonus of 6 per cent., making 16 per cent. for the year. This is a fall of 1½ per cent. on 1937-38.

Chadburn's (Ship) Telegraph Co.—At the annual meeting in July it was intimated that an interim dividend would be paid for the current year. In view of the change of conditions arising from the outbreak of war, and the extreme pressure on staff arising out of the Government requirements, the directors have been compelled to reconsider their intention. The works, it is stated, are busy, and the board hopes that the results of this year's trading will compare satisfactorily with that of last year.

Sterling Industries, Ltd. (formerly Ismay Industries) is postponing the dividend due on January 1st on the 5¼ per cent. cumulative preference shares. Dividend on the £350.000 of preference capital is in arrear from July 1st. 1938.

The Shawinigan Water & Power Co. has announced an interim dividend of 23 cents for the quarter to December 31st (same).

The United River Plate Telephone Co. is maintaining its interim dividend at 1 per cent.

The Montreal Light, Heat and Power Consolidated is paying a dividend of $0.38 on the common shares for the December quarter (same).

Telephone Rentals, Ltd., is maintaining its interim dividend at 4 per cent.

STOCKS AND SHARES

TUESDAY EVENING.

TWELVE months ago it was written here in a review of the Stock Exchange year that 1938 had been, frankly speaking, a bad period for investment. The crisis of that September had produced a feeling of anxiety which made its influence felt both before and after the Munich meeting. The effects may be said to have extended into the current year which, from the investment point of view, has certainly been worse than its predecessor was.

The outbreak of war on September 3rd produced a semi-paralysis which, however, wore off by steady degrees. In the Great War of 1914-18 it took the Stock Exchange at least twelve months to return into anything approaching a normal state of business. The present war differs in many respects from the previous one. It can be said, for example, that the holder of stocks and shares found himself able to negotiate securities, either as a buyer or a seller, within a month after the formal outbreak in September last. Business has been greatly restricted by the system of cash dealings which was introduced by the Stock Exchange Committee, but transactions take place with a degree of freedom that, all things considered, is remarkable. The war, however, has taken severe toll in the way of depreciation, yet in certain cases, of which Cable and Wireless stocks are notable instances, the year finishes with prices well above those of twelve months back.

Electricity Supply Shares

Shares in the electricity supply companies that are connected with the Metropolis have been affected more severely than those of the provinces. In the country, the companies have enjoyed the advantage of being suppliers to industrial areas in which great activity has prevailed, and is still prevailing. The provincial companies are expected, in the majority of cases, to maintain their previously paid dividends, but that the London undertakings are fairly certain to make a cut in their distributions is generally assumed.

A representative table will show that the fall in share values of the Provincial and Scottish companies has not been very serious :—

Share	Dec., 1938	High 1939	Low 1939	Dec., 1939	Fall on Year
Bournemouth and Poole ...	67/6	68/3	57/–	58/9	8/9
Clyde Valley	36/3	37/9	27/6	33/3	3/–
Elec. Dis. Yorkshire	41/6	41/6	32/6	35/9	5/9
Lancs Light and Power ...	30/9	34/6	25/–	28/9	2/–
Midland Counties	35/–	38/9	30/–	35/–	—
Midland Elec. Power	40/–	41/9	35/–	36/3	3/9
North Eastern	30/–	32/3	23/6	27/6	2/6
Northampton	46/3	48/–	41/–	42/6	3/9
Scottish Power	35/–	38/9	28/6	32/6	2/6
Yorkshire Elec.	38/6	38/6	28/9	33/9	4/9

The London Companies

An average yield of something under 5 per cent. on the above group of shares in Provincial and Scottish undertakings reflects a good measure of confidence in the ability of these companies to maintain the dividends at or near last year's levels. Yields of from 5¾ per cent. on County of London up to as much as 7 per cent. on London Associated Electrics indicate, on the other hand, a disposition to allow a margin for contingencies in the case of the London companies' issues, whose comparatively less favourable experience is shown in the table :—

Share	Dec., 1938	High 1939	Low 1939	Dec., 1939	Fall on Year
City of London	32/–	33/9	23/6	26/6	5/6
County of London	44/6	46/9	28/–	36/3	8/3
London Assoc. Elec.	30/–	30/–	18/3	20/–	10/–
Metropolitan	48/3	51/–	35/–	37/–	11/3
Northmet Power	45/–	46/6	30/6	37/–	8/–
South London	31/6	30/9	23/9	22/–	9/6

As representative of holding companies' shares, Edmundsons, at 23s. 6d., are a florin down on the year.

Industrial Markets

The industrial markets had a gruelling experience in the weeks when, with the gilt-edged market frozen at the minimum prices, the brunt of necessitous liquidation in the early weeks of the war fell on marketable securities of all kinds. Leading industrial shares best fulfilled the qualification of marketability, and suffered, in consequence, the most severely. With the thawing of the gilt-edged market, the relief brought about a remarkable change of complexion among industrials, which lost little time in repairing the worst of their declines. In the last three months, money has steadily sought investment in the market, and, encountering the least disposition on the part of holders to part from sound stock, has found it as hard a matter to buy as it was, formerly, to sell. Due recognition is given to the uncertainties in the terrain, including the higher income tax, the taxation of excess profits, cost of production, official controls, export business, and the like; also the likely conditions for trade and business at the end of it all. One certainty, however, is the full employment of every business equipped for, or capable of adaptation to war work. While the equation in terms of company profits and dividends is no matter for exact calculation, the firm note on which the industrial markets end the year bespeaks quiet and firm confidence in the outcome.

That electrical equipment shares should have given a somewhat exceptionally good account of themselves is explained by the reports of heavy demands for equipment, and by the knowledge that the prospect of activity does not end with the war. Further, the group includes some of the best-established and financially soundest undertakings in the country. As this selection indicates, the declines over twelve months have generally been moderate, while useful gains occurred in certain instances :—

Share	Dec., 1938	High 1939	Low 1939	Dec., 1939	Change on Year
Assoc. Electrical Ind. ...	39/–	45/3	31/3	38/9	– 3d.
Babcock and Wilcox	35/9	48/–	37/–	41/3	+ 5/6
British Aluminium	54/6	58/9	48/9	50/–	– 4/6
British Insulated	4½	88/–	72/6	80/–	– 2/6
Callender's	3½	92/–	52/6	60/–	– 17/6
Crompton Parkinson (5/–) ...	22/6	21/–	12/6	17/6	– 5/–
English Electric	33/–	36/6	25/–	31/3	– 1/9
G.E.C.	76/6	82/–	61/3	75/–	– 1/6
Ever Ready (5/–)	21/–	26/–	18/–	26/–	+ 5/–
Johnson and Phillips	36/3	41/3	32/–	41/3	+ 5/–
J. Lucas	56/3	60/–	45/–	56/3	—
Siemens...	21/3	26/9	18/9	20/–	– 1/3

Callenders reduced the dividend in 1939 from 20 to 15 per cent. Ever Ready also paid less than before, but the present demand for batteries is reflected in the price of the shares, which finish the year at their highest point. Bigger dividends were distributed by General Electric and Babcock and Wilcox.

Communication Stocks

Reference has been made above to the fact that Cable and Wireless stocks have gone ahead during the period under review. This is due in part to an unexpectedly good showing that was made by the annual report of the combine, but, besides this, war conditions are deemed to be favourable to communication companies as a whole. Recognising the strength of these factors, both the investor and the speculator have been taking an active hand in the stocks, the rises in which stand out with greater prominence owing to the decline noticeable in many other departments.

Great Northern Telegraphs have come down from 37 to the neighbourhood of 20, in consequence of the threatening attitude assumed by Germany in regard to Denmark and Scandinavia. The Great Northern is a Danish concern with its head office at Copenhagen and its principal lines running across Europe and Asia. Marconi-Marines have improved on balance, the last dividend having exceeded expectation and giving rise to the impression that the company must be doing very well.

Cross currents, already mentioned, will account for the irregularity of the following price comparisons :—

Share	Dec., 1938	High 1939	Low 1939	Dec., 1939	Change on Year
American Tel. and Tel. ...	158½	210	159	205½	+47
Anglo-American pref. ...	100½	101½	82	94½	– 6
Cable and Wireless pref. ...	77½	95½	75	92½	+15
Cable and Wireless ord. ...	35½	57½	34	56½	+21
Great Northern	37	38	18	20½	– 16½
International Tel. and Tel. ...	10	10½	5	5	– 5
Marconi Marine	23/9	30/–	23/–	27/6	+3/9

Transatlantics

Owing to the war, the American rate of exchange has moved sharply against this country, with the automatic result that prices of dollar stocks have gone ahead. For instance, American Telephone and Telegraph is 47 points higher on the year, although the dividend remains at 9 per cent. at which, so far as can be seen at present, it is likely to continue. During the early part of the year, when the war clouds thickened, a good deal of investment-capital sought safety in dollar stocks, and its demand served to bring about a boomlet in American stocks and shares. On the outbreak of war, the British Government prohibited the export of capital and, in addition, required holders in this country of American stocks and shares to register particulars with the Bank of England. This latter step was taken to ensure that, if necessary, the securities could be utilised by the Government for obtaining exchange to be applied to purchases of war material in the United States and elsewhere. The net consequence has been a practical stoppage of active business between London and New York.

Miscellaneous Changes

In the gilt-edged market, the features of the year were the fixing of minimum prices with the object of preventing a demoralising slump on the outbreak of war; the subsequent freezing of the market at these prices, at which stock was to all intents and purposes unsaleable; and the great thaw, engendered by a sweeping return of confidence in the financial policy of the Government, in the process of which the minima have been left well behind. Ground has been lost on the year, however. Hence the falls of 4 to 5 points in Central Electricity Board issues. London Transport Board stocks were also under the influence of the poor results for 1938-9 and the cut in the dividend on the "C" stock, which is still frozen at the minimum price of 65, against 74 a year ago. The 5 per cent. "B" stock is 13 points lower at 102½. Home Railway stocks saw wide fluctuations, with useful gains on balance. Southern preferred is 8 points to the good at 65, after going to extremes of 75½ and 48. Other changes which may be picked out as being of general interest are the falls of 3s. in "Emmies" to 7s. 6d.; of 6s. 3d. in Palestine Electrics to 23s. 9d.; of 200 points in British Electric Traction deferred at 700; and the recovery of 1⅜ in Brazilian Tractions to 10½. Stock Exchange markets mirror the condition and beliefs of an important sector of the nation. The firm confidence with which they open the New Year affords, therefore, a dependable foundation for the hope of better things to come in 1940.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1939 Highest	1939 Lowest	Dividend Previous	Dividend Last	Price Dec. 27	Rise or Fall	Yield £ s. d.
Home Electricity Companies							
Bournemouth and Poole	68/3	57/-	15	15	58/9	—	5 2 0
British Power and Light	30/9	21/-	7	7	26/-	—	5 7 8
City of London	33/9	23/6	7½	7½	26/6	+1/-	5 13 2
Clyde Valley	37/9	27/6	8	8	33/3	—	4 16 3
County of London	46/9	28/-	10½	10½	36/3	—	5 16 0
Edmundson's:							
7% Pref.	31/6	27/6	7	7	28/-	—	5 0 0
Ord.	27/9	18/6	9	6	23/6	—	5 2 2
Elec. Dis. Yorkshire	41/6	32/6	9	9	35/9	—	5 0 5
Elec. Fin. and Securities	47/9	40/-	12½	12½	40/-	—	6 5 0
Elec. Supply Corporation	51/9	41/-	12	12	41/3	—	5 16 0
Isle of Thanet	20/-	15/-	4	4	15/-	—	5 6 8
Lancs Light and Power	34/6	25/-	7½	7½	28/9	—	5 4 4
Llanelly Elec.	22/6	17/6	5½	5½	19/-	—	5 15 9
Lond. Assoc. Electric	30/-	18/3	7	7	20/-	+6d.	7 0 0
London Electric	34/3	22/6	7	7	25/-	—	5 12 0
London Power Deb. Red.	106½	98	5	5	103½	—	4 16 6
Metropolitan	51/-	35/-	12	12	37/-	—	6 9 9
Midland Counties	38/9	30/-	8	8	35/-	—	4 11 5
Mid. Elec. Power	41/9	35/-	8	9	36/3	—	4 19 4
Newcastle Elec.	28/9	26/-	7	7	26/3	—	5 6 8
North Eastern Electric:							
Ordinary	32/3	23/6	7	7	27/6	—	5 1 10
7% Pref.	32/6	27/6	7	7	30/-	—	4 13 4
Northampton	48/-	41/-	10	10	42/6	—	4 15 0
Notting Hill 6% Pref. (£10)	12½	11½	6	6	11½	—	5 4 4
Northmet Power:							
Ordinary	46/6	30/6	10	10	37/-	—	5 8 1
6% Pref.	29/-	23/6	6	6	27/-	—	4 9 0
Richmond Elec.	29/-	21/6	7	7	23/9	—	5 18 0
Scottish Power	38/9	28/6	8	8	32/6	—	4 18 6
Southern Areas	22/9	17/-	5	5	18/-	—	5 11 1
South London	30/9	22/-	7	7	22/-	—	6 7 3
West Devon	23/3	18/9	5	5	18/9	—	5 6 8
West Glos	21/3	16/3	2	2½	16/3	—	3 1 6
Yorkshire Elec.	38/6	28/9	8	8	33/9	—	4 14 10
Overseas Electricity Companies							
Atlas Elec.	4/3	1/6	Nil	Nil	3/-	—	—
Calcutta Elec.	39/-	25/-	10*	10*	31/-	+6d.	—
Cawnpore Elec.	34/6	28/3	10	10	27/6	—	—
East African Power	26/3	20/-	7	7	23/6	—	5 19 2
Jerusalem Elec.	24/6	21/-	7	7	21/-	—	6 13 4
Kalgoorlie (10/-)	10/6	9/-	7½	7	10/-	—	7 0 0
Madras	31/-	21/3	8*	8*	21/3	—	—
Montreal Power	35½	30	1½	1½	33½	—	—
Palestine Elec. "A"	29/6	20/-	7½*	5*	23/9	—	4 4 0
Perak Hydro-electric	19/6	13/6	6	2½	19/6	—	2 11 4
Shawinigan Power	25	20	85cts.	83cts.	25	—	—
Tokyo Elec. 6%	63	37	6	6	57½	—	10 8 8
Victoria Falls Power	73/9	60/-	12½	15	67/6	—	4 8 9
Whitehall Investments Pref.	19/6	12/6	7½	7½	14/-	—	10 14 2
Public Boards							
Central Electricity:							
1950–70	112	103	5	5	106½	—	4 14 0
1955–75	115½	104½	5	5	108	—	4 12 6
1951–73	106½	101	4	4½	103	—	4 7 3
1963–93	95½	84	3½	3½	90	—	3 18 7
London Elec. Trans. Gtd.	88½	83	2½	2½	87	—	2 17 6
London & Home Counties							
1955–75	107½	105	4½	4½	107	—	4 4 1
Lond. Passenger Transport:							
A	114½	103	4½	4½	104½	−1	4 6 2
B	117½	102	5	5	102½	−1	4 17 7
C	83½	64½	4	1½	65	—	2 6 2
West Midland Joint Elec.,							
1948–68	112½	104½	5	5	106	—	4 14 4
Telegraph and Telephone							
American Tel. & Tel.	210	159	9	9	205½	—	4 7 8
Anglo-Am. Tel.:							
Pref.	101½	82	6	6	94½	+2	6 7 0
Def.	23⅜	18½	1½	1½	21½	—	6 19 6
Anglo-Portuguese	24/-	17/6	8	8	20/-	—	8 0 0
Cable & Wireless:							
5½% Pref	95½	75	4½	5½	92½	—	5 19 0
Ord.	57⅛	34	4	4	56⅜	−1	7 1 8
Income	100	87½	—	—	93½	+2	4 5 7
Canadian Marconi $1	6/-	3/9	—	Nil	5/-	—	—
Globe Tel. & Tel.:							
Ord.	31/3	23/6	7½*	7½*	27/6	—	5 9 1
Pref.	26/9	22/6	6	6	25/-	—	4 16 0
Great Northern Tel. (£10)	38	18½	20	20	20½	—	9 15 2
Inter. Tel. & Tel.	10½	5	Nil	Nil	5	—	—
Marconi-Marine	30/-	23/-	7½	10	27/6	+1/6	7 5 6
Oriental Telephone Ord.	2½	46/3	12*	12*	2 1/16	—	5 4 0
Radio Corpn.	8⅛	5⅛	8	6	7½	—	—
Telephone Props.	14/-	12/9	5	6	13/9	—	8 14 6
Telephone Rentals (5/-)	10/-	7/-	10	10	8/-	—	6 5 0
Western Union	40½	19½	2½	—	32½	—	—
Traction and Transport							
Anglo-Arg. Trams:							
First Pref. (£5)	7/6	3/6	Nil	Nil	5/-	—	—
4% Inc.	16	5	Nil	Nil	10	—	—
British Electric Traction:							
Def. Ord.	1025	515	5	5	700	—	—
Pref. Ord.	164	130	8	8	142	—	5 12 8
Bristol Trams	52/6	36/3	8	10	42/-	—	4 15 5
Brazil Traction	13	7½	$1	50c.	10½	—	—
Calcutta Trams	25/6	20/9	8	8	21/3	—	7 10 6
Cape Elec. Trams	18/-	16/9	5	5	17/-	—	5 17 8
Lancs Transport	37/9	27/6	10	10	30/-	—	6 13 4
Mexican Light:							
1st Bonds	30	20	5	5	30	—	—
Rio 5% Bonds	82	47	5	5	80	—	6 5 0
Southern Rly.:							
5% Prefd.	75½	48	5	5	65	—	7 13 9
5% Pref.	99½	79	5	5	89	—	5 12 4
T. Tilling	2½	32/6	10	10	38/9	—	5 3 3
Tilling & B.A.	54/6	43/9	10	9*	45/-	—	4 2 3
West Riding	37/9	30/-	10	10	30/-	—	—
Equipment and Manufacturing							
Aron Electricity Ord.	32/3	22/6	15	15	22/6	—	—
Assoc. Elec.:							
Ord.	45/3	31/3	10	10	38/9	—	5 3 0
Pref.	36/6	31/3	8	8	32/6xd.	—	4 18 6
Automatic Telephone & El.	47/6	39/3	10	12½	42/6	—	5 17 8
Babcock & Wilcox	48/-	37/-	10	12½	41/3	+6d.	6 1 1
British Aluminium Ord.	58/9	48/9	12½	12½	50/-	—	5 0 0
British Insulated Ord.	88/-	72/6	20	20	80/-	—	5 0 0
British Thermostat (5/-)	16/-	12/-	18½	18½	12/6	—	7 8 0
British Vacuum Cleaner (5/-)	22/6	12/6	40	12½	10/-xd.	−2/3	6 5 0
Brush Ord.	5/9	3/9	Nil	Nil	4/-	—	—
Callender's	92/-	52/6	20	15	60/-	—	5 0 0
Chloride Elec. Storage	82/3	62/6	20	15	3½	—	4 5 9
Consolidated Signal	96/-	62/6	36½	36½	65/-	—	9 14 8
Crabtree (10/-)	25/6	17/6	17½	17½	21/3	—	8 4 9
Crompton Parkinson:							
Ord. (5/-)	21/-	12/6	15	20	17/6	—	5 14 3
E. K. Cole (5/-)	9/-	3/-	10	Nil	4/6	+6d.	—
Elec. & Musical Industries (10/-)	14/9	7/-	5	Nil	7/6	—	—
Electric Construction	38/6	31/-	12½	13½	33/9	—	8 0 0
Enfield Cable Ord.	58/6	42/6	25	16½	46/3	—	7 0 5
Electrical Switchgear (10/-)	27/-	21/-	16	10	21/3	—	4 14 3
English Electric	36/6	25/-	10	10	31/3	—	6 8 1
Ensign Lamps (5/-)	16/9	13/9	25	25	15/-	—	8 6 8
Ericsson Tel. (5/-)	43/-	35/-	25*	25*	35/-	—	3 11 5
Ever Ready (5/-)	26/-	18/-	35	30	26/-	+6d.	5 15 5
Falk Stadelmann	27/-	17/6	10	6	18/9	—	6 13 4
Ferranti Pref.	25/6	21/-	7	7	21/3	—	6 11 9
G.E.C.:							
Pref.	31/9	26/3	6½	6½	27/6	—	4 14 6
Ord.	82/-	61/3	17½	20	75/-	—	5 4 4
Greenwood & Batley	27/6	22/6	7	15	22/6	—	13 6 8
Hall Telephone (10/-)	22/3	18/6	15	15	18/9	—	8 0 0
Henley's (5/-)	21/-	15/-	20	20	17/6	—	5 14 3
4½% Pref.	23/-	18/9	4½	4½	18/9	—	4 16 0
Hopkinsons	46/3	37/3	12½	15	42/6	—	7 1 0
India-Rubber Pref.	21/3	18/9	5½	5½	20/-	—	5 10 0
Intl. Combustion	120/-	97/-	32½	32½	5½	—	5 13 0
J. Lucas	60/-	45/-	15	15	56/3	—	5 6 9
Johnson & Phillips	41/3	32/-	12½	12½	41/3	—	6 1 4
Lancashire Dynamo	72/-	50/-	25	25	55/-	−1/-	9 1 10
Laurence Scott (5/-)	12/-	9/6	15	15	9/6	—	7 18 4
London Elec. Wire	31/6	26/-	12	7½	26/3	—	5 14 4
Mather & Platt	50/-	39/-	13½	13½	44/6	−6d.	6 1 8
Metropolitan Elec. Cable Pf.	21/3	21/-	5½	5½	21/3	—	5 3 0
Murex	85/9	63/9	20	20	80/-	+5/-	5 0 0
Pye Deferred (5/-)	13/9	7/6	25	25	7/6	—	16 13 4
Revo (10/-)	35/6	20/-	17½	17½	21/3	—	8 4 9
Reyrolle	61/-	52/6	12½	12½	60/-	—	4 3 4
Siemens Ord.	26/9	18/9	7½	7½	20/-	—	7 10 0
Strand Elec. (5/-)	5/6	2/-	10	4	2/-	—	8 0 0
S. Smith (1/-)	9/-	6/-	37½	50	7/6	—	6 13 4
Switchgear & Cowans (5/-)	15/-	10/-	20	20	11/3	—	8 18 0
Telegraph Condenser (10/-)	7/6	5/-	5	—	7/6	—	—
Telegraph Construction	2½	32/6	10	10	32/6	—	6 3 1
Telephone Mfg. (5/-)	10/-	7/-	9	9	8/-	—	5 12 6
Tube Investments	91/-	72/6	23½	23½	88/9	—	5 8 0
Vactric (5/-)	4/3	2/3	4	Nil	2/6	+3d.	—
Vickers (10/-)	24/6	14/6	10	10	16/6	—	6 1 3
Ward & Goldstone (5/-)	22/6	19/6	20	20	19/9	—	5 1 3
Westinghouse Brake	54/9	36/-	17½	17½	2½	—	7 15 6
Walsall Conduits (4/-)	31/9	21/3	55	55	25/-	—	8 16 0
West, Allen (5/-)	7/6	5/9	7½	10	5/9	—	8 14 0

* Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Australia. — BRISBANE.—January 15th. City Electric Light Co., Ltd. Two steam boilers and accessories. H. Baskerville, secretary, Boundary Street, Brisbane, Queensland.

Febuary 14th. Nine automatic voltage regulators. (T. 29608/39.)*

February 22nd. 11-kV automatic reclosing switchgear. (T. 29937/39.)*

MELBOURNE.—January 30th. Posts and Telegraphs Department. Braided cable. (T. 30032/39.)*

Batley.—January 1st. Corporation. L.v. cables for twelve months. (December 22nd.)

Birmingham.—January 10th. Salvage Department. Fifteen lead-plate batteries for electric vehicles. (December 22nd.)

Erith.—January 1st. Electricity Department. Wiring of lighting and water heating points, and extension to fire alarm system at Bedonwell Hill School, Belvedere. (December 15th.)

Hucknall.—January 8th. U.D.C. Electrically driven pumping set at Salterford pumping station. Specifications from Rofe & Raffety, 42, Salisbury Avenue, Cheam (deposit £2 2s.).

Iran.—TEHRAN.—January 6th. Centrale Electrique de Tehran. Electrical plant, including turbo-alternators, high-voltage cable, transformers, &c. (T. 29037/39.)

March 1st. Ministry of Industry and Mines. Machinery for a cane sugar factory. (T. 23403/39.)*

Leeds.—January 2nd. Corporation. Electric bed and service lifts at St. James's Hospital; Kitson, Parish, Ledgard and Pyman, Lloyds Bank Chambers, Vicar Lane, Leeds, 1 (deposit £2 2s.).

Luton.—January 8th. Rural District Council. Supply and fixing of two borehole pumps, electric motor and oil engine, together with incidental works, at Kensworth; H. Pickering, 73, West Parade, Dunstable, Beds (deposit £2 2s.).

Manchester.—January 2nd. Electricity Committee. Rewiring of premises (Spec. 718); H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall, Manchester, 2 (deposit £1 1s).

January 12th. Domestic cookers for twelve months. (See this issue.)

January 18th. Supply, delivery and erection at the central control room and various sub-stations of batteries and charging equipments. (See this issue.)

Morecambe and Heysham.—January 5th. Electricity Department. Supply, jointing and pressure testing of e.h.v. cables. Excavating, laying and permanent reinstatement. (December 15th.)

Newport (Mon).—December 30th. Electricity Department. Supply of lamps for electrical installations under the assisted wiring scheme. Forms from A. Nichols Moore, borough electrical engineer, Electric House, Dock Street, Newport.

New Zealand. — WELLINGTON.—Public Works Department. January 16th. Two sets of 11,000-V metal-clad switchgear. (T. 28857/39.)*

January 23rd. Four 110-kV three-phase outdoor isolating switches. (T. 29122/39.)*

February 6th. Two motor driven centrifugal pumps. (T. 29120/39.)*

February 13th. Three single-phase transformer units. (T. 28146/39.)* Two 2,250-kVA three-phase boosting transformers. (T. 28144/39.)* Remote control equipment. (T. 28791/39.)*

February 20th. Seven single-phase transformer units. (T. 28148/39.)* Four single-phase transformer units. (T. 28147/39.)*

February 27th. 22,000-V switchgear. (T. 28858/39.)* 11,000-V switchgear. (T. 28789/39.)*

March 12th. 110-kV outdoor switchgear and steelwork. (T. 28145/39.)*

March 26th. Four single-phase transformer units. (T. 28143/39.)*

South Africa.—CAPE TOWN.—January 15th. Electricity Department. Booster pumps, complete with driving motors, &c., and piping, two sets of motor starting and control gear, two 3,300-V iron-clad switchboards, two 380/220-V iron-clad distribution boards and one overhead travelling crane. (T. 27966/39.)*

January 17th. Automatic fire protection equipment. (T. 29487/39.)*

DURBAN.—January 19th. General Stores Department. Electrically driven trenching machine. (T.Y. 29779/39.)* Overhead frogs and insulated crossing, &c. (T. 29780/39.)*

February 2nd. 6,600-V switchgear. (T. 29782/39.)

Wolverhampton.—January 15th. Electrical Engineer's Department. E.h.v. switchgear. (December 15th.)

Orders Placed

Bedford.—Electricity Committee. Recommended. Internal telephone installation at office extensions (£216).—Dictograph Telephones.

Recommended for twelve months: Meters.—Metropolitan Vickers Electrical Co.; Chamberlain & Hookham; Venner Time Switches. Cooker control units.—H. W. Holland. Meter boards and house service fuses.—W. T. Henley's Telegraph Works Co. Cookers.—Jackson Electric Stove Co.; Revo Electric Co. Water heaters.—Johnson & Phillips. Kettles.—Bulpitt & Son. Transformers.—British Electric Transformer Co.

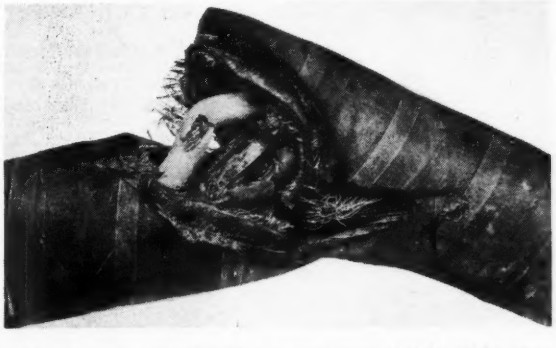
London.—FULHAM. — Electricity Committee. Main transformer and high voltage cables for the further extension of the power station (£23.459).—Metropolitan Vickers Electrical Co., (Tenders at a similar figure were submitted by the British Electric Transformer Co. and the English Electric Co., but the Metropolitan Vickers' tender was accepted because that company installed similar plant in former extensions.)

LEWISHAM.—Works Committee. Accepted. 50 pedestrian crossing beacons.—Revo Electric Co.

(Continued on next page.)

Screened Trailing Cables

THE two-fold function of screens on trailing cables (as recommended by the Mines Department) is to prevent accidental contact with a live wire and to make the cable dead immediately, by means of an earth-leakage relay, should a core make contact with an earthed screen. The accompanying photograph, taken at a South Wales colliery, shows the effect of a fall, from about 5 ft., of a stone 10 in. thick with a knife edge on a cable supplying a working coal cutter. Two screens and one power core were severed and two other power cores were damaged, but microscopic examination showed no sign of sparking.



Although two screens and a power core of this cable were cut by a fall of stone no sparking occurred

The cable was of the G.E.C. double-screen type and was used in conjunction with a gate-end box and automatic control equipment of the same make certified by the Mines Department as intrinsically safe (*i.e.*, methane proof). The two concentric screens, which cover the power and earth cores collectively, were insulated from each other, the outer one being earthed and the inner fed from a low-voltage supply.

Relays connected in series caused the gate-end contactor to trip instantaneously, due to the metallic connection made between the screens owing to the fault.

Reducing Lamp-stem Temperatures

PREMATURE failures of large tungsten-filament lamps are often attributable to overheating of the stems due to heat reflected from the fitting. Rays of light from the lamp strike a smooth reflector and return along the same path through the focal axis, and this results in a high concentration of radiant energy directed along the axis of the reflector; on this axis are the lamp stem, filament, leads and supports. The *General Electric Review* (U.S.A.) describes how this heat concentration has been reduced by diverting the heat rays slightly to one side of the focal axis, without sacrificing the efficiency and good distribution characteristics of the "luminaire." By the use of a reflector of the same contour, but stepped with forty-eight vertical flutes, it is reported that the stem temperature in a 500-W lamp has been reduced from 436 to 158 deg. F. These flutes have the additional advantage when used with mercury lamps of reducing the loss of efficiency that results from absorption of reflected light in the arc.

Middlesex.—Drainage Committee. Accepted. Electrical equipment at Mogden pumping station (£3,700).—Lancashire Dynamo & Crypto.

Health Committee. Accepted. Electrical installation at Holly House Farm, Enfield (£240).—Middlesex Electrical Co.

Swansea.—Electricity Committee. Accepted. Transfer of 12,500-kW set from Strand to Tir John station (£5,376).—British Thomson-Houston Co. Electrostatic flue-gas cleansing plant for Tir John station (£81,560 plus £8,440 for contingencies).—Lodge-Cottrell. Maclane tippler equipment for coal storage (£2,300).—F. Lane. Switchgear (£33,072).—Ferguson, Pailin.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Anglesey.—Conversion of the Memorial Hall, Amlwch, into secondary school; J. Elfed Rees, county architect, Glanaber, Llangefni.

Ashby-de-la-Zouch.—Extensions to factory for John Ferguson, Ltd.; Orton and Son, contractors, Kilwardby Street, Ashby-de-la-Zouch.

Ayr.—Decontamination centre, for T.C.; J. and J. A. Carrick, architects, Ayr.

Crematorium for County Council (£11,000); architect, County Council, Ayr.

Bedlington.—Completion of 70 houses and erection of store at Council depôt; U.D.C. surveyor.

Bexhill-on-Sea.—Extension and alterations, Town Hall, for T.C.; borough surveyor, Town Hall.

Billingham-on-Tees.—Additional office accommodation and recreation hall at the fire station; J. H. Hill, surveyor.

Blackpool.—Erection of emergency hospital; Caton & Duckworth, Ltd., contractors, William Henry Street, Blackburn.

Bridlington. — Report and control centre, for T.C.; borough architect, Town Hall.

Brighton.—Rest rooms and canteens, Rottingdean, and Moore's Garage, for A.R.P. committee; borough surveyor.

Carlisle.—Completion of 134 houses, Wigton Road, Raffles-Newtown, and Petteril Bank estates, and of 150 houses on Belah estate; borough surveyor.

Clayton.—Warehouse; J. Walsh (Cotton Waste), Ltd., Victoria Street.

Coldwaltham (PULBOROUGH).—Development of land adjoining London-Bognor road; F. S. Vickery, Stocks Mead, Washington.

Darlington.—Bakehouse, Bondgate, for G. C. Zissler; H. E. Jarvis, architect, High Row Chambers, Darlington.

Air raid shelter at Northgate, for Marks and Spencer; Jones and Rigby, architects, Southport.

Air raid shelter for Darlington Training College; W. S. Hutton, Ltd., builders, Post House Wynd, Darlington.

Darlaston.—Mission Church at Bentley for Rev. C. E. Turner, vicar of St. Giles, Willenhall.

Dudley.—School in Halesowen Road, Dudley (£16,900) for the E.C.; Hickton, Madeley & Salt, architects, Ashley House, Haverton Road, Walsall.

Dumfries.—Extensions to Carnation Milk Factory, for General Milk Products, Ltd.; manager.

Dundee.—Houses for attendants, Dundee Mental Hospital, Westgreen, for Hospitals Sub-Committee; city surveyor.

Additions to factory, for South Anchor Jute Works, Ltd., Anchor Lane; manager.

Factory for Urquhart Lindsay & Robertson Orchar, Ltd., Bellfield Street; manager.

Durham.—Alterations to Hatfield Hall for Durham County E.C.; F. W. Goodyear and Son, builders, 60, Claypath, Durham.

Edinburgh.—New shopping centre, site of Waverley exhibition hall; city surveyor.

Refrigerating plant and switchgear house, Fountain Brewery, Fountainbridge; W. M'Ewan & Co., Ltd.

Eire.—(LIMERICK).—Houses (366); C. Stenson, city engineer, Town Hall, Limerick.

DUBLIN.—Converting firemen's quarters, Tara Street Fire Station, into offices, stores, lecture room, &c.; city architect, 1-3, Parliament Street.

Fareham.—Control room; U.D.C. surveyor.

Gravesend.—Underground fire station (£11,000); borough engineer and surveyor.

Hayes and Harlington.—Control and report centre; U.D.C. surveyor, Town Hall, Hayes, Middlesex.

Irthlingborough.—Extensions to factory, Station Road, for Keunen Bros.

Keynsham.—Fire station, and proposed public offices, Bath Hill site, for U.D.C.; W. A. Williams, architect, Bath.

Liverpool.—Large laboratory building, Brownlow Hill and Brownlow Street, for the University; H. E. Davies, architect, Wellington Buildings, Strand, Liverpool.

Llandudno.—Reservoir and two pumphouses, for U.D.C.; surveyor, Town Hall.

London.—BERMONDSEY.—Bacon factory, Abbots Lane; Hay's Wharf, Ltd., Tooley Street, S.E.1.

LEWISHAM.—Depôt extensions (£3,900); Henry Kent (Builders), Ltd., 51, Beacon Road, S.E.13.

POPLAR.—Additions to Hope Chemical Works, Wallis Road; Hal Williams & Co., factory architects, 43, Bedford Square, London, W.C.1.

Alterations and additions for Baldwin's, Ltd., Orchard Place; Structural Engineering Co., Carpenters Road, E.15.

New premises for Watts, Ltd., Kelday Road; J. & J. Dean, Ltd., Ruckholt Works, Ruckholt Road, E.10.

Additions to Millwall Boiler Works, Ferry Street; J. Fraser & Son, Ltd., Millwall, E.14.

Manchester.—Store and showroom, rear of existing market hall, Barlow Moor Road, Chorlton-cum-Hardy, for J. A. Taylor, Deansgate House, 274, Deansgate.

Erection of cinema, Wilmslow Road and Heaton Road, Withington, for Alfred F. Deacon & Co., 13, St. Ann's Square, Manchester; Drury & Gomersall, architects, 15, Oxford Road.

Factory, Boardman Street, Ashton New Road, Clayton; Clayton Aniline Co., Ltd., Crabtree Lane, Clayton, Manchester.

Houses (219); J. Hughes, housing director, Town Hall.

Conversion of disused church into factory, for David Matz (Manchester), Ltd., 3, Catherine Street; J. Bailey, contractor, 72, Market Street, Droylsden, Manchester.

Baptist Sunday School, Crossacres Road, Northern Etchells, for Manchester and District Baptist Association, Milton Hall, Deansgate, Manchester; Southern & Davies, contractors, Thorley Lane, Timperley, Ches.

Additions to factory, Harper Road, Northenden, for G.P.A. Tools and Gauges, Ltd., Derby Street, Cheetham; Matley, Brotherton and Mills, architects, 39, Oxford Street, Manchester.

Office and stores, Crabtree Lane, Clayton, for Eva Bros., Ltd., Crabtree Forge, Clayton; D. Goodyear & Sons, Ltd., contractors, Abbey Works, Abbey Hey Lane, Openshaw, Manchester, 18.

Cloth store, Grey Street and Ogden Lane, Openshaw, for Lindsay & Williams, Ltd., 1121, Ashton Old Road, Manchester, 11; Brown & Jones, builders, 3, Carter Street, Ardwick, Manchester, 15.

Rebuilding factory after fire, Vickers Street and Pochin Street, Miles Platting, for Frank Walters & Co., Ltd.; Cruickshank & Seward, architects, 16, Princess Street, Manchester.

Middlesbrough.—Additions to North Ormesby Hospital; Kitching and Co., architects, 21, Albert Road, Middlesbrough.

Alterations and additions, Albert Mews, for A. Hinton and Son; Archibald and Archibald, architects, 25, Albert Road, Middlesbrough.

Air raid shelter for Marks and Spencer, Ltd.; Bell and Bell, architects, Whitby Street, West Hartlepool. Air raid shelter, Borough Road, for North-Eastern Gazette; Kitching and Co., architects, 21, Albert Road, Middlesbrough.

Middlesex.—Additions to Central Hospital (£7,770); John Harrison (London), Ltd., Station Works, Denmark Road, London, S.E.5.

Middleton.—Extensions to offices, Boarshaw Clough, for Chadwick & Smith, Ltd., Boarshaw Works, Middleton; H. Ogden and Co., builders, Old Road, Middleton, Manchester.

Morley (YORKS).—Extension of Alexandra Mills, for W. B. Stockwell, Baker Street, Morley; Irving Ainsworth, contractor, 6, Britannia Road, Morley.

Rebuilding Empire Cinema in Thorpe Road, East Ardsley, for Empire (East Ardsley), 1939, Ltd.; Pennington, Hustler & Taylor, architects, 45, Ropergate, Pontefract.

Newcastle-on-Tyne.—Additions to Benwell refuse disposal plant, for the City Council; P. Parr, city engineer.

North Shields.—Fish store at Cliffords Fort Moat; Stirk Brothers, fish merchants, North Shields.

Orrell (NEAR WIGAN). — Methodist church (£7,000) for the Methodist Union Association; Pennington & Unwin, architects, Malvern Chambers, Library Street, Wigan.

Plymouth.—Air raid shelter (600 persons), basement of Devonport Market, and shelter (200 persons), St. Peter's Hall, Plymouth, for War Emergency Committee; borough surveyor.

Preston.—New garden village of St. Christopher, off the main Preston-Blackpool Road at Westby-with-Plumpton; F. B. Lumb, architect, 19, Clifton Street, Blackpool.

Reading.—Extensions to factory, for Gascoignes & Reading, Ltd., Castle Street.

Rotherham.—Works alterations, Greasborough Road; Home Baking Co.

Workshop, Sheffield Road; Steel, Peech and Tozer, Ltd.

Runcorn.—Air raid shelters, each to accommodate 40 to 50 persons (£40,000); A. B. Cunningham, surveyor, County Offices, Runcorn.

Sedgefield.—Public shelters; R.D.C. surveyor.

Somerset. — Schools, Martock and Somerton, for E.C.; county architect, Park Street, Taunton.

Stockport.—Branch library in Heaton Moor Road; W. F. Gardner, borough engineer and surveyor, Town Hall.

Stockton-on-Tees.—Completion of new maternity home for the T.C. (£30,000); A. S. Knolles, borough engineer.

Alterations to the Wild Ox public house for J. W. Cameron & Co.; G. P. Stainsby, architect, 25, High Street, Stockton-on-Tees.

Houses, Cleveland Avenue; A. E. Hobbs, builder, Hill House, Norton, Stockton.

Stoke-on-Trent.—Houses (24), Queen's Road, Penkhull; H. W. Cartlidge.

Works additions, Stoke Road; Diamond Clay Co., Ltd.

Swansea. — Offices, Morfyld Street; Morgan, Harris & Co.

Taunton.—Printing works and offices, Bathpool; Arthur W. Parker & Co., estate agents, Taunton.

Houses, Priorswood Road; Colborne's Estates, Ltd.

Wakefield.—A.R.P. shelters for Patons and Baldwins, Ltd., Worsted and Woollen Spinners, Rutland and Thornes Mills.

Walsingham.—Houses (34), Field Dalling, Little Ryburgh, Morston, South Raynham, and Wighton; R.D.C. surveyor.

Warrington. — Decontamination unit, Lythgoes Lane; Lyants Co., Ltd.

Shelter and first-aid depôt, Howley Lane; J. and W. N. Hutchings, Ltd.

Public air raid shelters, various parishes, for R.D.C.; surveyor, Museum Street.

Wellington (SOMERSET).—Houses (22), Nynehead, Budgetts Cross, and Hill's Farm, Fitzhead; R.D.C. surveyor.

West Hartlepool.—Completion of the Dyke House Senior School for the E.C.; borough engineer.

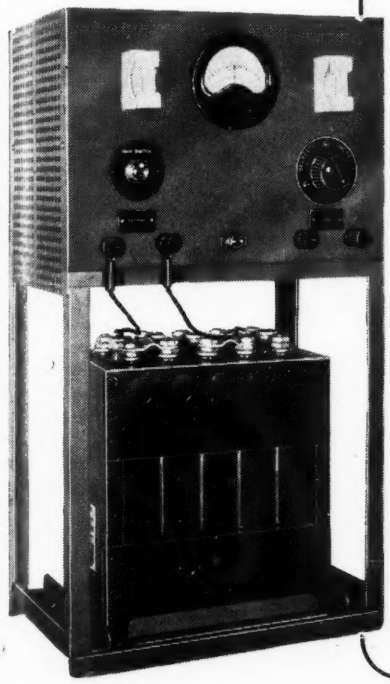
Houses, the Oval; Sampie Brothers, builders, West Hartlepool.

Wigan.—Extensions to Rose Bridge Mill, for J. S. Rapaport & Co., 45, Julia Street, Manchester; I. Isaacs, architect, 1, New Brown Street, Manchester.

Wrexham.—Houses at Marchwiel; J. Herbert Edwards, engineer and surveyor, Imperial Buildings, Wrexham.

A.R.P.

EMERGENCY LIGHTING UNIT FOR AIR RAID SHELTERS



This unit has been designed specifically for use in industrial and public air raid shelters where complete reliability, simplicity and compactness are essentials.

Under normal conditions the lights are floated across the battery, which is maintained in a fully charged condition by a slight trickle charge so that, on failure of mains supply, the battery supplies the load without interruption. All units incorporate ammeter, trickle/boost charge control, input and output fuses and main switch.

WRITE FOR →

a copy of our new 20-page booklet containing full technical details of Heayberd Rectifying Equipment, also a copy of List "L" 1032 describing the HEAYBERD A.R.P. Emergency Lighting Equipment, complying with BS/ARP. 6.

F. C. HEAYBERD & CO. LTD
10, FINSBURY STREET, LONDON, E.C.2
Tel.: MET. 7516 (5 lines)
Manufacturers of Electrical, Industrial and Scientific Equipment

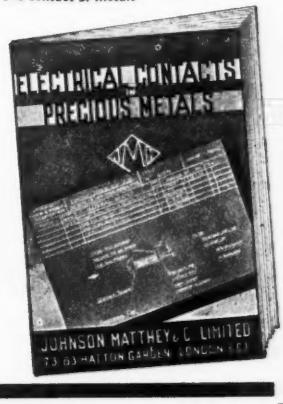
JMC PRECIOUS METAL CONTACTS -YOUR BASIS FOR ACCURACY

J.M.C. contacts are supplied for use in ignition contacts, railway signalling devices, gun firing mechanisms, printing telegraph systems, searchlight equipment and practically every type of electrical apparatus where absolute accuracy and reliability are essential.

They are made in any desired form, and quotations are given for customers' requirements upon receipt of a specification, blue print or sketch.

We are called upon daily to assist by suggestion and experiment in the designing of precious metal contacts for use in all kinds of electrical equipment. The services of our experts are also at your disposal for advice regarding contact design and material.

Our Publication No. 112 contains further information regarding J.M.C. contacts and contact bi-metal.



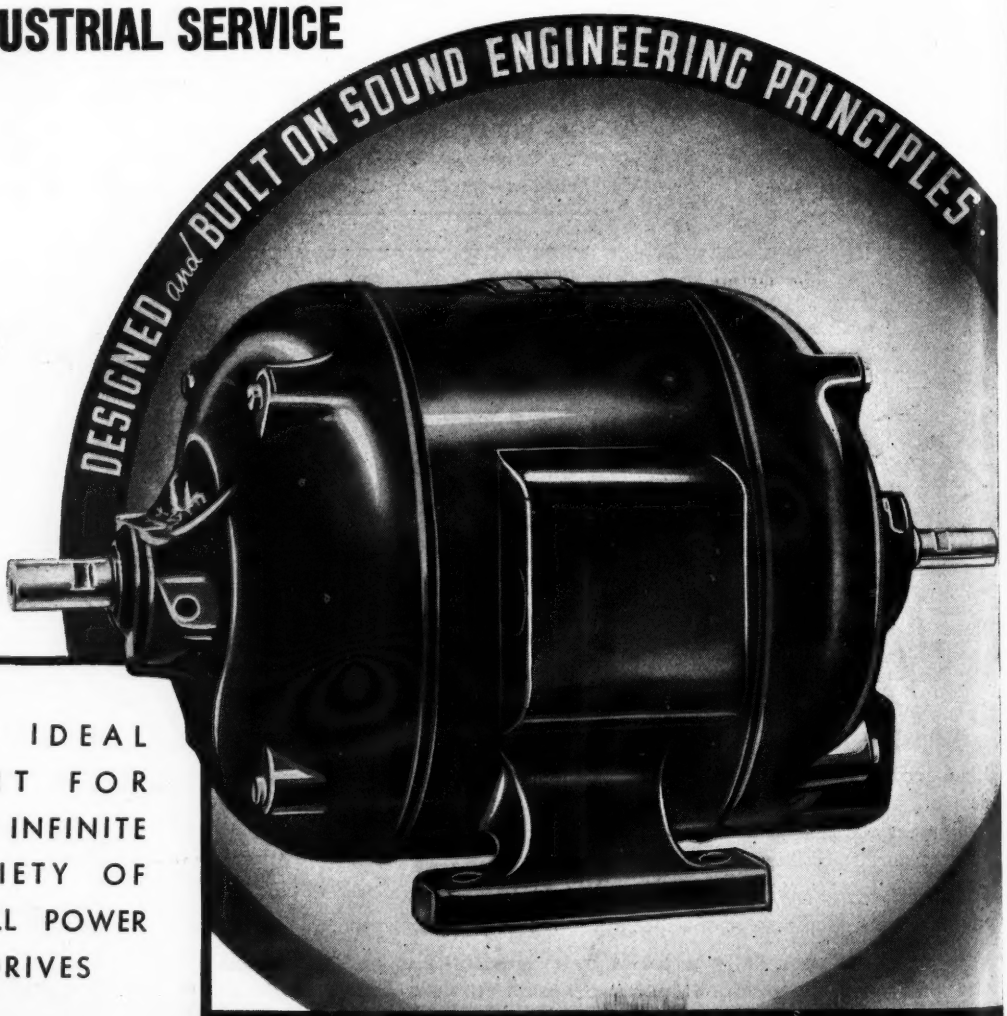
JOHNSON, MATTHEY & CO., LIMITED
73-83, HATTON GARDEN, LONDON, E.C.1
HOLBORN 6989

G.E.C.

Pioneer Manufacturers in England of

FRACTIONAL H.P. MOTORS

MOBILIZED IN HUNDREDS OF THOUSANDS FOR INDUSTRIAL SERVICE



THE IDEAL UNIT FOR AN INFINITE VARIETY OF SMALL POWER DRIVES

Standard Types and Special Models

Advt. of The General Electric Co., Ltd. Head Office: Magnet House, Kingsway, London, W.C.2

Classified Advertisements

ADVERTISEMENTS for insertion in the following Friday's issue are accepted up to **5.30 p.m. on Tuesday**, at Dorset House, Stamford Street, London, S.E.1.
THE CHARGE for advertisements in this section is 1/9 per line per insertion, or for display advertisements 14/- per inch, with a minimum of one inch.
FOR SITUATIONS VACANT AND WANTED there is a special reduced rate of 1d. per word if prepaid, minimum 1/-. A Box Number, when required, is charged as six words, and there is also in this case an additional charge of 6d. for postage of replies. Three insertions under these headings can be obtained for the price of two if ordered and prepaid with the first insertion. If placed to account the charge for each insertion is 2/6 for three lines and 9d. for each additional line.
Original testimonials should not be sent with applications for employment.

REPLIES TO advertisements published under a Box Number if not to be delivered to any particular firm or individual should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Letters of applicants in such cases cannot be returned to them. The name of an advertiser using a Box Number will not be disclosed. All replies to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. Cheques should be made payable to ELECTRICAL REVIEW LTD and crossed. Postal Orders and notes are legal tender and cannot be traced if lost in transit. They must therefore be regarded as being despatched at sender's risk Alternatively they may be sent per registered post.

OFFICIAL NOTICES—TENDERS ETC

CITY OF MANCHESTER

THE Electricity Committee invites tenders for the following:—

SPECIFICATION NO. 719.
Supply and delivery, during a period of twelve months, of DOMESTIC ELECTRIC COOKERS.

SPECIFICATION NO. 721.
Supply, delivery and erection at the CENTRAL CONTROL ROOM AND VARIOUS SUB-STATIONS of BATTERIES and CHARGING EQUIPMENTS for SWITCHGEAR and SUPERVISORY CONTROL EQUIPMENT OPERATION.

Specifications and Forms of Tender may be had on application to Mr. H. C. Lamb, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2, on payment of a fee of one guinea for each specification, which amount will be refunded on receipt of a bona fide tender.

Tenders, duly endorsed and addressed to the Chairman of the Electricity Committee must be delivered at the Town Hall not later than the dates mentioned hereunder:—

Specification No. 719.
10 a.m. on Friday, 12th January, 1940.

Specification No. 721.
10 a.m. on Thursday, 18th January, 1940.

The firms entrusted with the work will be required to enter into a contract to be prepared by the undersigned.

The Corporation does not bind itself to accept the lowest or any tenders.

R. H. ADCOCK,
Town Clerk.

Town Hall,
Manchester, 2.
22nd December, 1939. 2139

SITUATIONS VACANT

DRAWING OFFICE DUTIES

VACANCIES exist for civilians with electrical training for drawing office duties in H.M. Signal School, Portsmouth.

Applicants should:—

(i) Have had workshop and preferably some Drawing Office experience with a reputable electrical firm in one or other of the following types of work:—
(a) Radio Transmitters and Receiving Apparatus.
(b) Electrical Switch and Control Gear.
(c) Electrical Machinery.
(d) Ship Electrical Equipment.
(e) Communication circuits and Apparatus (Telephone, etc.).
(f) Light Mechanical or Electrical Instruments.

Note.—Candidates without previous Drawing Office experience will be considered provided they have had electrical manufacturing workshop experience.

(ii) Be 23 years of age or older.

(iii) Be natural born British subjects, the children of persons who are, or were at the time of death, British subjects.

Men employed by firms engaged on Government contracts should not apply. Candidates who appear suitable will either be granted an interview at their own expense or offered a short period probationary appointment before being definitely accepted. Those selected will be paid a salary within the limits of £3 15s. and £4 12s. 6d. per week, according to age, qualifications and experience.

The posts are non-pensionable and are expected to last for the duration of hostilities or one year, whichever is longer. They will be terminable by one month's notice on either side.

Application forms may be obtained from THE CAPTAIN, H.M. Signal School, R.N. Barracks, Portsmouth. 2102

SITUATIONS VACANT—*Continued*

VACANCIES exist for Civilians with Engineering, Electrical and/or Shipbuilding training for Drawing Office Duties as Draughtsmen in Mine Design Department, H.M.S. "Vernon," Portsmouth.

Applicants should:—

(i) Have had workshop and drawing office experience with a reputable firm, or firms, in one or other of the following types of work.
(a) General Mechanical Engineering.
(b) Light Mechanical Apparatus, Mechanisms or Electrical Instruments.
(c) Electrical Machinery or Equipment.
(d) Marine Engineering, preferably on ship equipment.

(ii) Be 23 years of age or older.

(iii) Be natural born British subjects, the children of persons who are, or were at the time of death, British subjects.

Candidates who appear suitable will either be granted an interview at their own expense or offered a short period probationary appointment before being definitely accepted.

Those selected and passing a local medical examination will be paid a salary within the limits of £3 15s. and £6 per week, according to age, qualifications and experience.

The posts are non-pensionable and are expected to last for the duration of hostilities.

They will be terminated by one month's notice on either side.

Applications should give full Christian and surnames, date of birth, nationality, full particulars of training, practical experience, qualifications, positions held and salary required, together with the names of two referees to the Superintendent of Mine Design, H.M.S. "Vernon," Portsmouth. 2097

WARWICKSHIRE EDUCATION COMMITTEE

Nuneaton and District Further Education Committee

APPLICATIONS are invited for full-time appointment in the County Mining and Technical School, Nuneaton, from men qualified to teach Electrical Engineering in day and evening classes. A degree and some teaching experience required.

Burnham Technical Scale.

Further information can be obtained from Mr. D. E. Thomas, B.Sc., M.I.Min.E., Principal, County Mining and Technical School, Nuneaton, to whom all applications must be forwarded so as to reach him not later than January 3rd, 1940.

J. C. BENNELL,
Organiser of Further Education.

Council House,
Nuneaton. 2095

AN OPPORTUNITY FOR A LIVE MAN

A FIRM manufacturing high class fractional horse-power motors requires a Production Manager with a thorough electrical and mechanical knowledge of this particular product. The position would be a permanent one, carrying a good salary and excellent prospects. First class men with these qualifications should apply to Box 2081, c/o The Electrical Review. Applications will be treated in strict confidence, and should give full details of experience.

E. K. COLE, Ltd., have vacancies in their Southend-on-Sea factory for well qualified men in the following capacities:—

Foreman with light metal machine shop experience.

Capstan Setter, fully experienced.

Tool Maker for Press Tools.

Aluminium Welding Setter.

Write, stating age and full details of training and experience, to Employment Records Section, E. K. Cole, Ltd., Southend-on-Sea, or call during normal working hours. 2073

SITUATIONS VACANT—*Continued*

AIR MINISTRY

Civilian Instructors Required

VACANCIES EXIST FOR CIVILIAN FITTER AND METAL AIRCRAFT RIGGER INSTRUCTORS at an initial rate of pay of £4 5s. a week inclusive, increasing to £4 10s. on the satisfactory completion of a probationary period, and thereafter by annual increments of 2s. 6d. a week to £5 a week.

The necessary qualifications are: Fitter Instructors must be capable of lecturing and of demonstrating the theory of the internal combustion engine and of undertaking instruction in dismantling and erecting engines. Aero-engine experience and use of precision tools are essential.

Metal aircraft rigger instructors must be capable of lecturing and demonstrating the working of light metal tubes and plates as used in airframe construction. Knowledge of the rigging of airframes is required.

Applications should be addressed to the Under-Secretary of State (S.5.d.), Air Ministry, Kingsway, London, W.C.2, giving particulars as to previous experience, age, &c. Suitable applicants who must be over 30 years of age, will then be required to attend at the nearest Royal Air Force trade testing centre for the necessary trade test and medical examination. 30

BOROUGH OF BARNSTAPLE

Electricity Department

APPLICATIONS are invited for the position of WORKING FOREMAN ELECTRICIAN. Candidates must not be less than 30 years of age and should have a sound experience in the installation of domestic apparatus, and its reconditioning; the wiring of domestic and commercial premises and the supervision of stores. A working knowledge of radio will be considered an advantage. Wages 1s. 6½d. per hour (normal week of 48 hours).

Applications, stating age, experience and date when duties can be commenced should be directed to the undersigned not later than January 4th, 1940.

The appointment is superannuated and subject to medical fitness

R. ROBINSON, M.I.E.E., A.M.I.Mech.E., M.I.Min.E.,
Borough Electrical Engineer.

Castle Street,
Barnstaple, N. Devon. 2111

NORTHAMPTON POLYTECHNIC,

St. John Street, London, E.C.1.

APPLICATIONS are invited for the post of Lecturer in the ELECTRICAL ENGINEERING DEPARTMENT.

Candidates should be of good academic standing and should have suitable industrial experience.

Qualifications for advanced teaching in HEAVY CURRENT ELECTRICAL ENGINEERING are essential.

Salary in accordance with LONDON BURNHAM SCALE with the possibility of an allowance up to £24 for special responsibility.

Particulars of the appointment and application form will be forwarded on request.

Applications should be accompanied by copies of three testimonials and should be submitted not later than 8th January, 1940.

S. C. LAWS, M.A., M.Sc.
2118

ASSISTANT Foreman required by firm of Electrical Contractors in Birmingham area.—Apply Box 2134, c/o The Electrical Review.

ASSISTANT, with knowledge of Electric Light Fittings, especially Industrial types, required for Lighting Fittings Department. Ability to keep records and handle customers telephoned enquiries essential.—State age, experience and salary required to Crompton Parkinson, Ltd., Ref. LP/20, Bush House, London, W.C.2. 2137

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SITUATIONS VACANT—*Continued*

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SENIOR Mechanical Draughtsman required, used to the design and detailing of small mechanisms and instruments. Excellent prospects for a quick accurate man. Write stating age, experience and salary required to Box 2141, c/o The Electrical Review.

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WINDERS wanted, used to general repair shop work.—Apply Midland Electric Installation Co., Ltd., Cyprus Works, Wolverhampton. 2104

SITUATIONS WANTED

A CAPABLE man, 20 years' experience electrical industry, accounts, buying, sales, secretarial, departmental management, requires similar employment, permanency, West London or Eastern Counties preferred.—Box 9793, c/o The Electrical Review.

A FIRST Class Representative, age 42, ten years last position, sound knowledge Midlands, wide experience engineering, electrical, radio. Capable administrator, keen organiser inside or out. Highest credentials. Would also consider sole commission agencies of repute.—Box 9890, c/o The Electrical Review.

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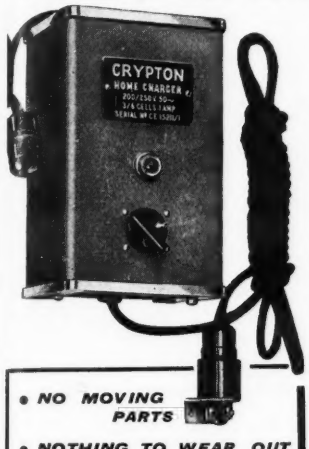

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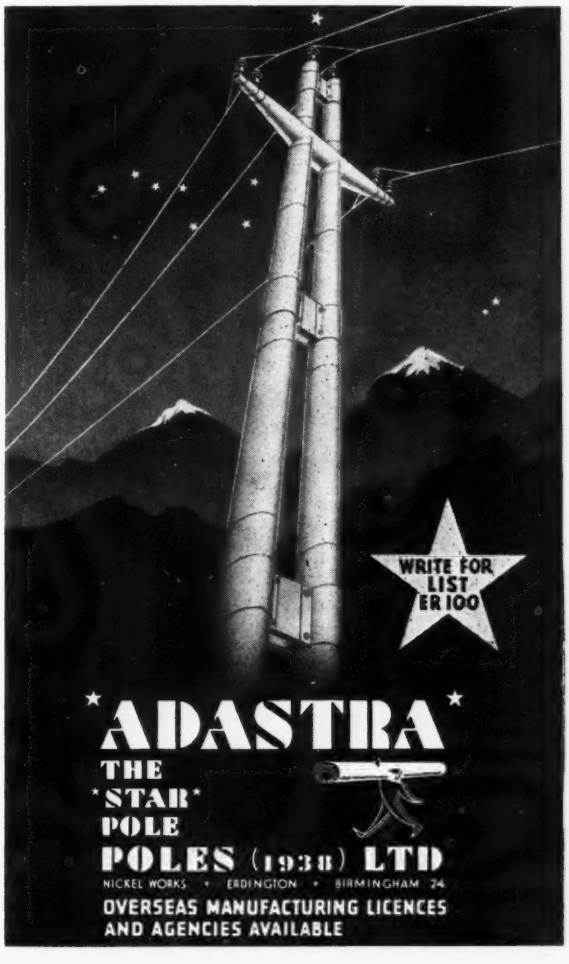

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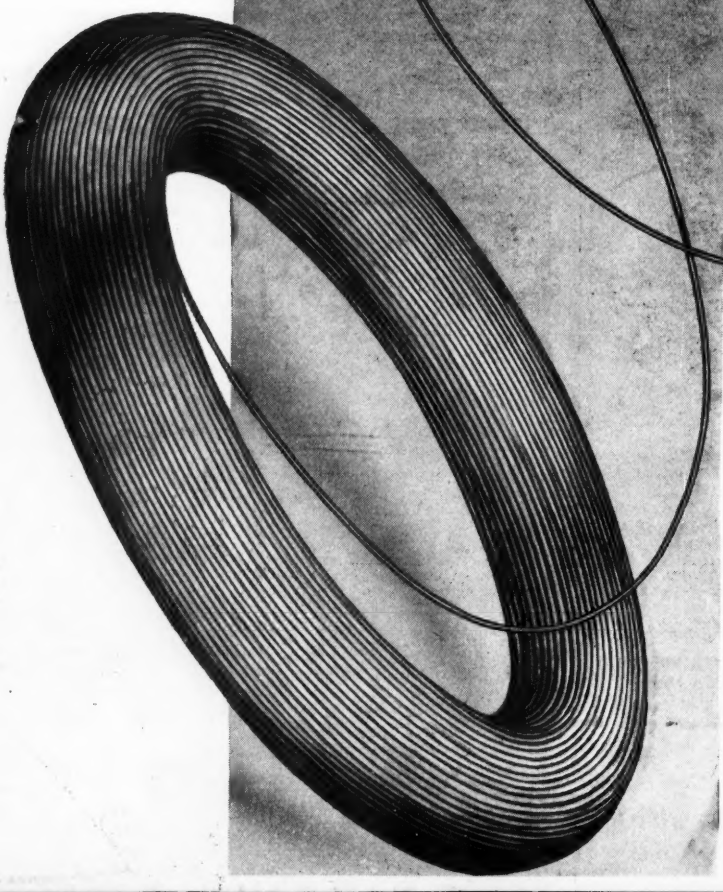

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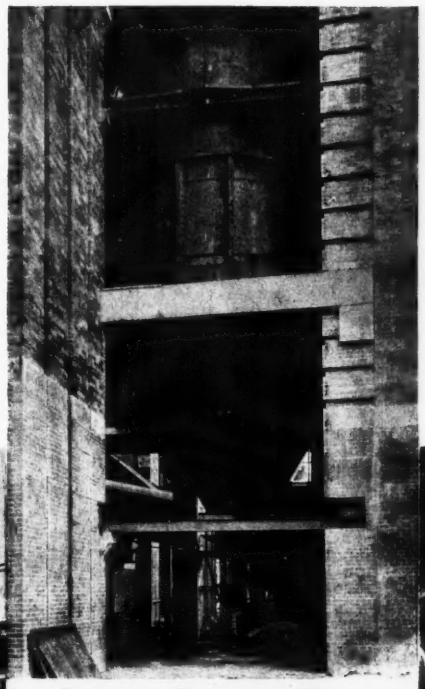

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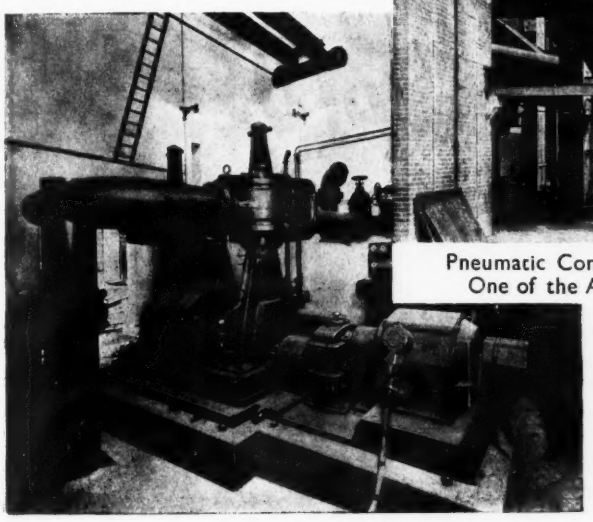
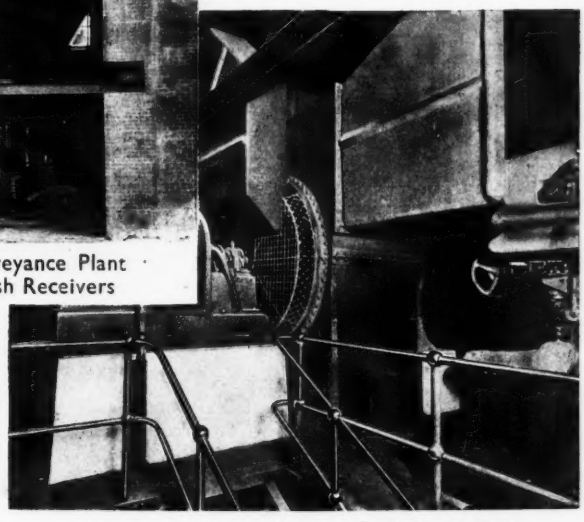
One of the Ash Receivers

"SIROCCO" Pneumatic Conveyance Equipment, as supplied, provides Ash Handling and Riddlings Removal services for the whole of the Steam-raising Plant in the Power Station, comprising 18 Boilers.



Pneumatic Conveyance Plant :
The Exhauster House



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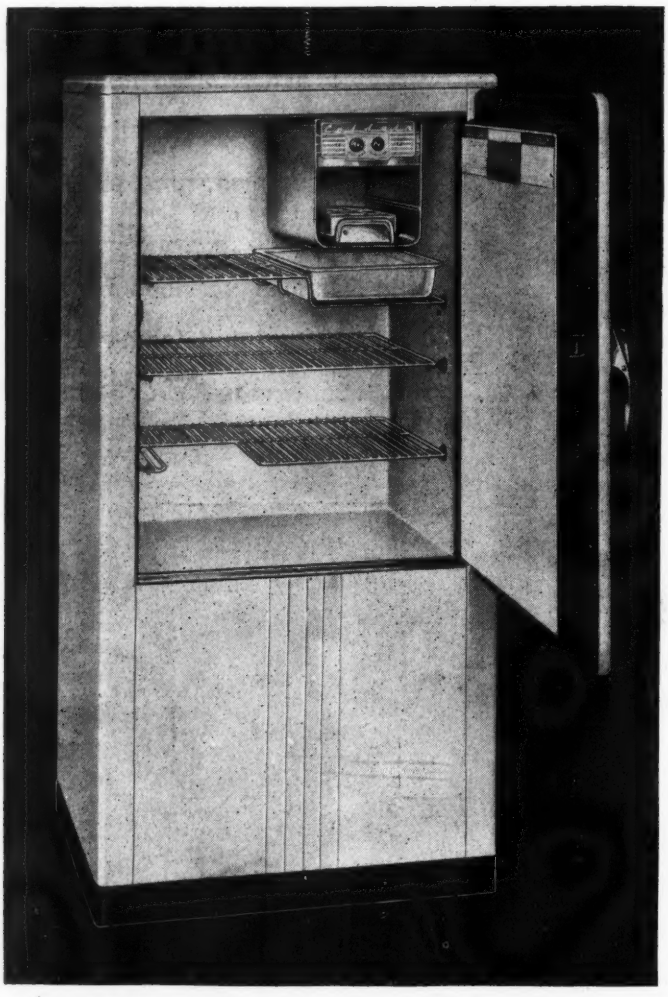

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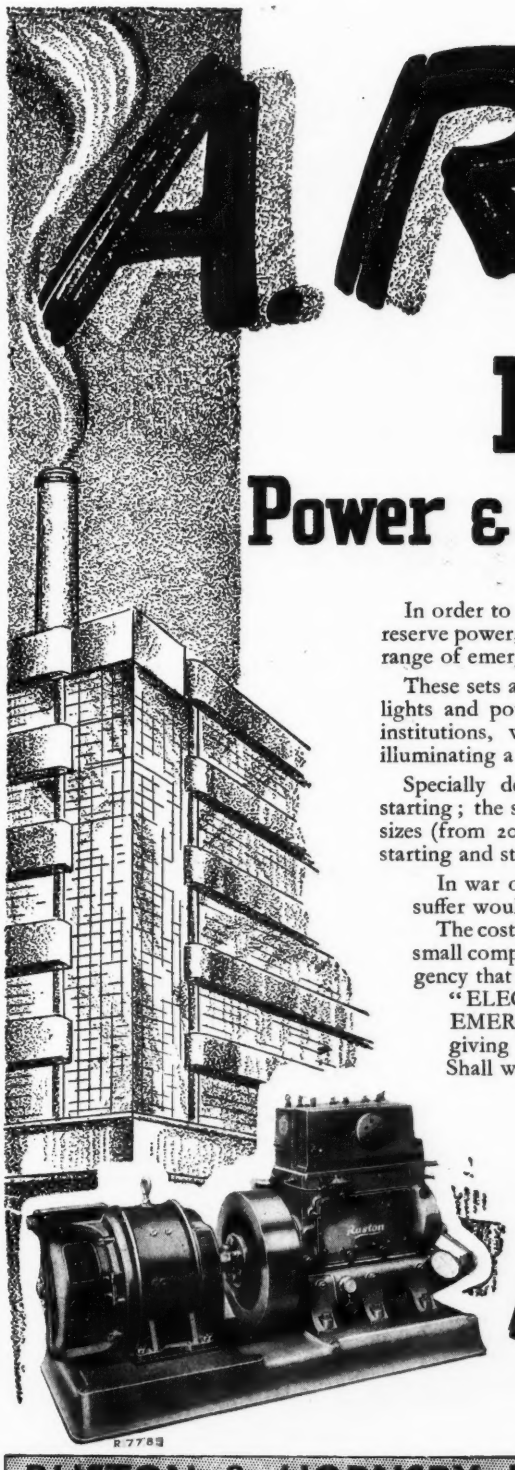

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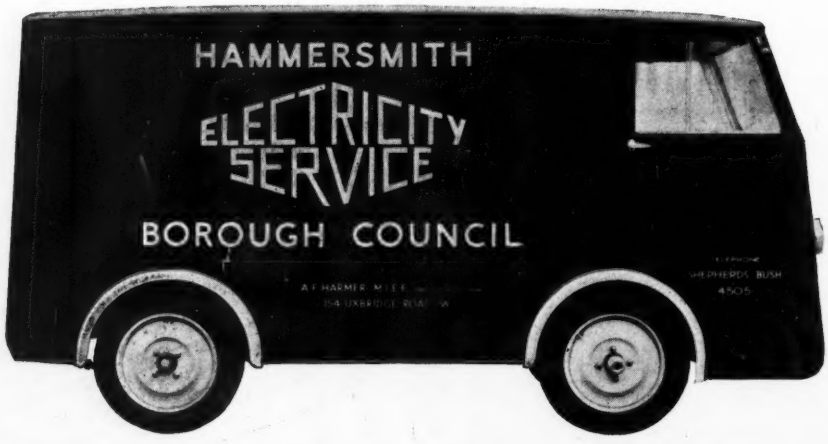

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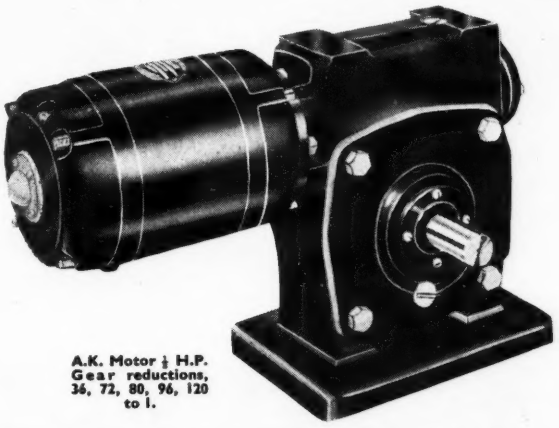

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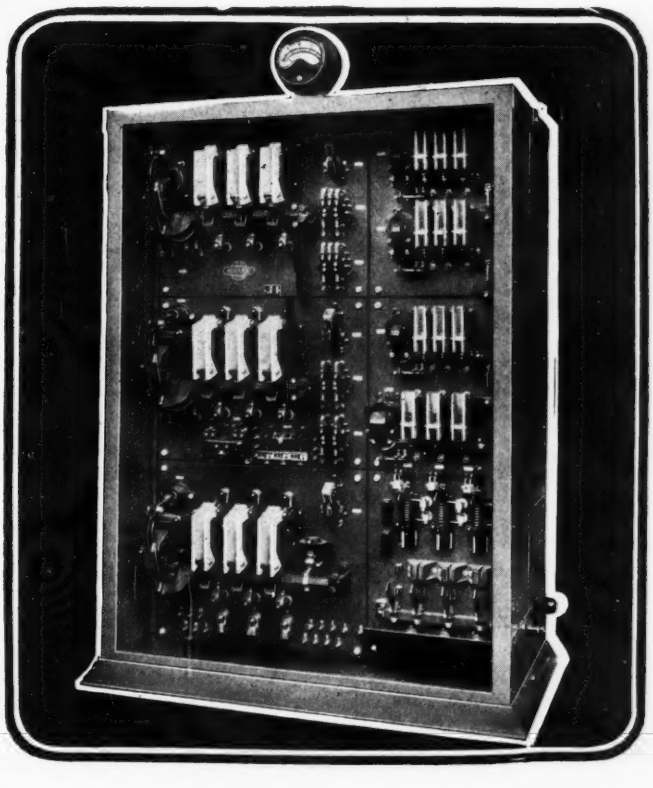

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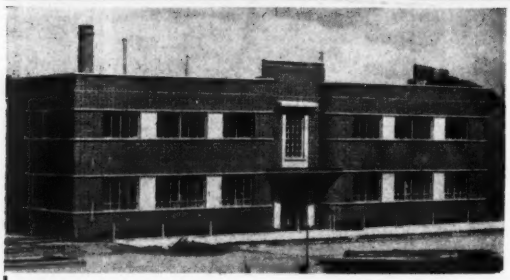

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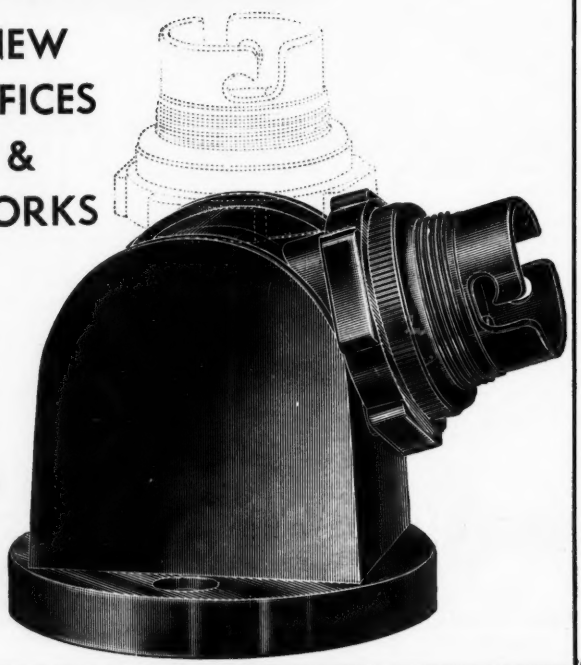

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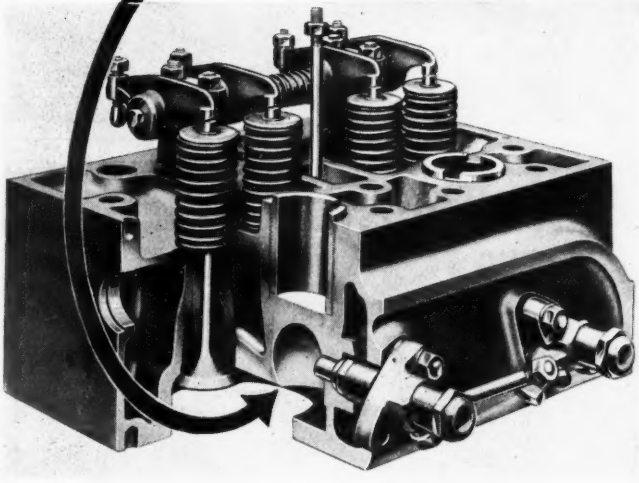

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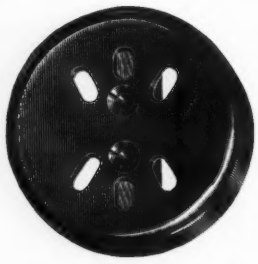

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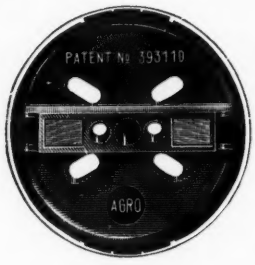

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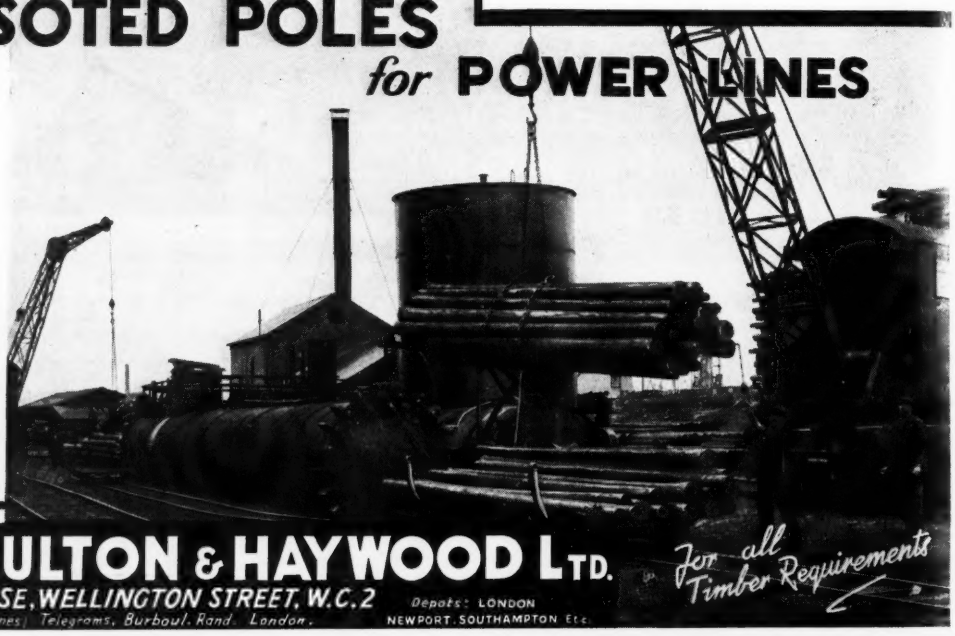

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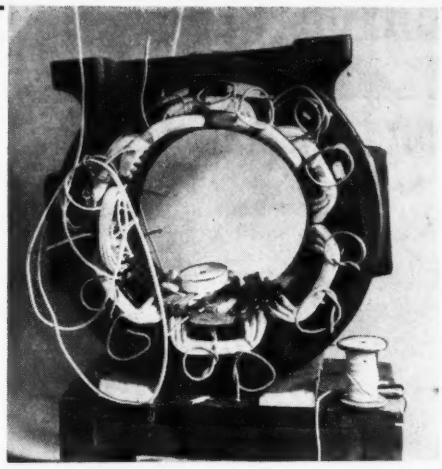

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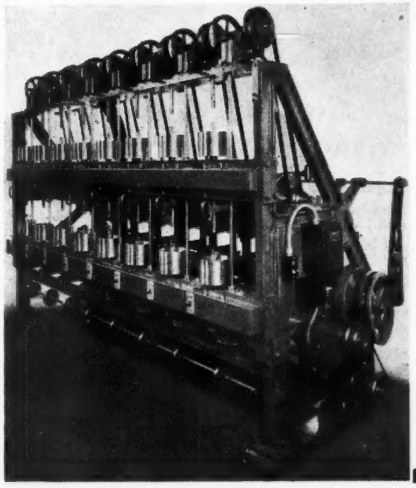

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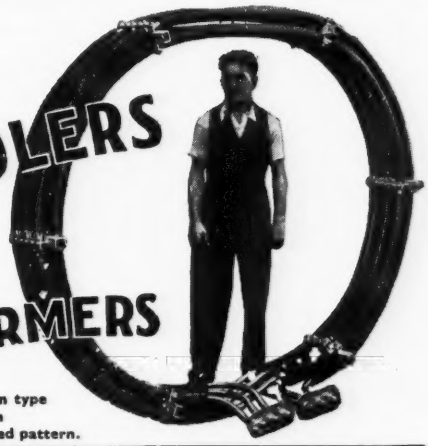

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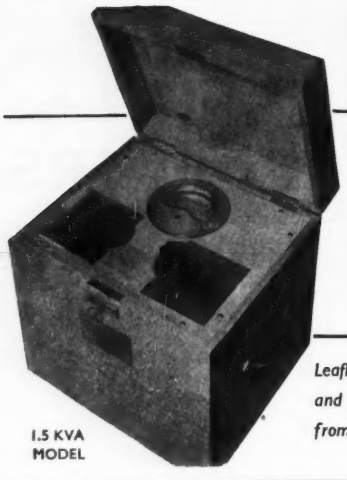

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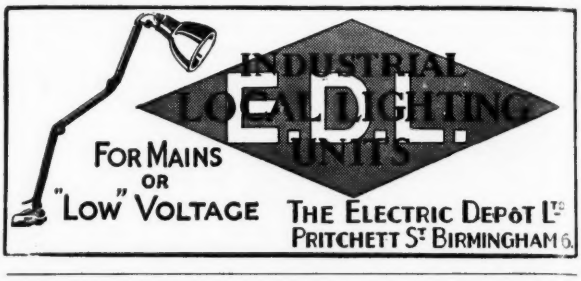

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Fig. 52
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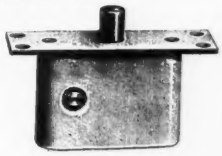

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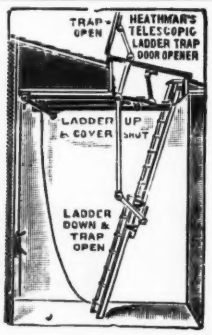

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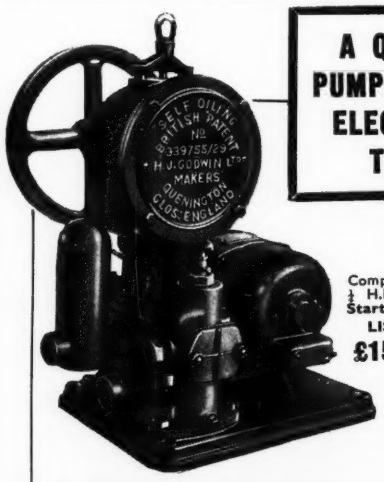

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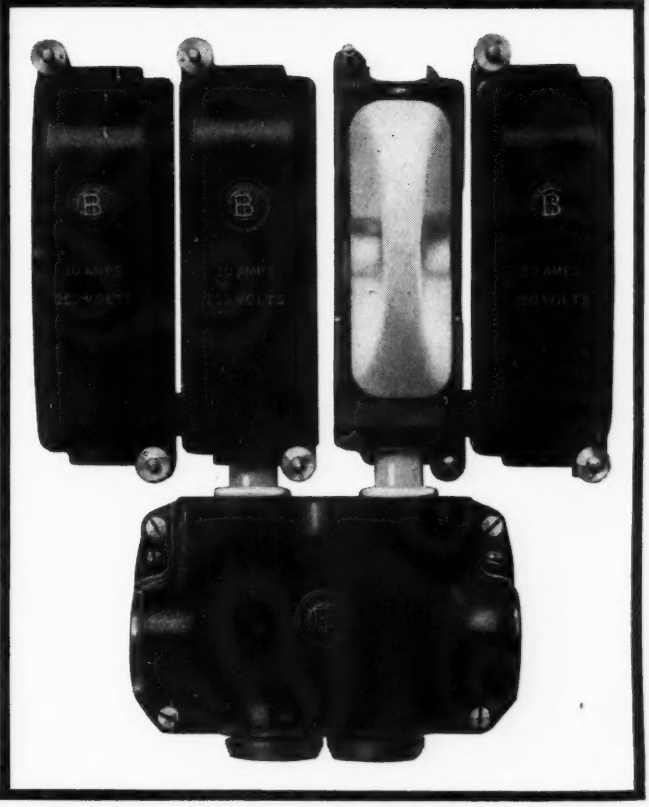
The illustration shows a group of B.I. Busbar Cut-outs with four-entry Sealing Chamber.

British Patent Nos. 217010, 354049, 355859, 412671



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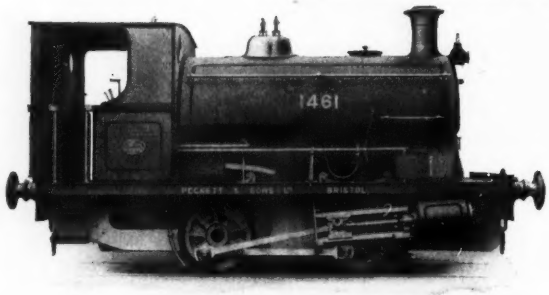

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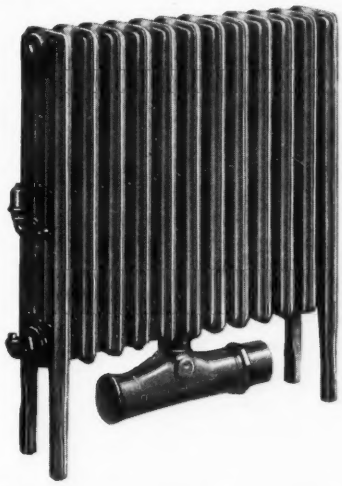

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